THE EISENHOWER LIBRARY
3 1151 02695 8771

MORAVIA
SPEC. COLL.

THV THESIS
Gover,
Mary
1923
C.1

THE JOHNS HOPKINS UNIVERSITY
SCHOOL OF HYGIENE AND PUBLIC HEALTH
310-312 W. MONUMENT STREET
BALTIMORE, MD.

DR. GOVER'S THESIS

PUBLISHED

JOHNS HOPKINS HOSPITAL REPORTS

VOL. XX1, 1923, p. 231-295

A STATISTICAL STUDY OF THE ETIOLOGY OF GOITER WITH SPECIAL REFERENCE TO THE THYROID GLAND

Dissertation

Submitted to the School of Hygiene and Public Health

of the Johns Hopkins University

in conformity with the requirements for the Degree of

Doctor of Science in Hygiene.

Mary Gover

April, 1923.

A STATISTICAL STUDY OF THE ETIOLOGY OF BENIGN HYPERTROPHY OF THE PROSTATE GLAND.

By

Mary Gover.

CONTENTS

1. Collection and Tabulation of Data.
2. Historical Account.
3. Discussion of Problem: Constants Employed.
4. Method of Classification for Size.
5. Prostatic Hypertrophy and Age
   a. Curve of Increase in Size of Prostate.
6. Prostatic Hypertrophy and Venereal History.
7. Prostatic Hypertrophy and Heredity.
8. Prostatic Hypertrophy and Social Status.
9. Prostatic Hypertrophy and Past History.
10. Prostatic Hypertrophy and Heart and Blood Pressure.
11. Summary.
12. Bibliography.

1. Collection and Tabulation of Data.

The case history room of any large hospital contains material in abundance for the detailed study of various biological and medical problems. Anyone who has attempted to assemble and tabulate by hand data from bound volumes of case histories on enormous sheets of paper, as is the custom, knows the vast amount of labor and time necessarily involved before adequate data can be collected. It is impossible by this method to collect, and what is more important, to tabulate more than a relatively small number of items, provided a large number of histories, say 1000 or more, has to be examined.

One purpose of the present study is to show that with the aid of modern statistical methods the minutest detail which it might be desirable to know in the course of a thorough investigation of a special problem, can be collected and made available for tabulation in every conceivable manner and with a minimum amount of effort. Data from 997 cases of prostatic hypertrophy including a series of 807 consecutive perineal prostatectomies performed by Dr. H. H. Young, in the Brady Urological Institute of the Johns Hopkins Hospital have been transferred to punch cards for a monographic study of prostatic hypertrophy. The punch cards in use in this study carry a literally enormous amount of detailed information; 156 separate items for each case, requiring five cards in all, have been coded and transferred to punch cards for tabulation. Facsimilies of the card forms have been published in an article by Dr. Raymond Pearl on Modern Methods in Handling Hospital Statistics in the Johns Hopkins Hospital Bulletin for June 1921, but will also be included here for the sake of clearness. They constitute Figures 1 to 5. The headings of individual columns on the cards are largely

self-explanatory. The 156 items include (1) the patient's past history with special attention to the past history of the genito-urinary tract and venereal history, (2) the present illness, including the age at onset of obstructive symptoms, (3) general physical examination, including the secondary sex organs in detail and a heart examination, (4) rectal findings, (5) urethra and bladder cystoscopy with residual urine in c. c., (6) preliminary treatment, consisting mainly of types of drainage, (7) detailed description of the operation, (8) hospital ward notes, including complications and such facts as the date of closure of the fistula, etc., (9) condition on discharge and (10) a follow-up, including details of the patient's condition when last heard from, and the date and cause of his death if he is known to have died. On a final card is recorded the phenolsulphronphthalein output, first and second hour, and total with appearance time; this for admission, at operation and on discharge; also the patient's blood pressure, systolic and diastolic, on admission and at operation.

In order that the method of card punching may be clear part of one case history, Card No. 1, which contains the more general items, is represented as Figure 6. In the first five columns is punched the Brady Urological Institute history number. All five cards pertaining to one patient's history carry the same number in this position, in this case 4799. Column 7 carries the card number "1" and split-fielded in the same column, the information that the patient was discharged. Had he died in the hospital "9" would have been punched instead of "8". Father's age at death is 64, mother's 46. Fifty is the code number for diabetes mellitus in the International List of Causes of Death, 1918, 92 pneumonia; father's and mother's causes of death respectively. Reading from the next four columns on the card, the patient had 2 sibs, one of them alive at the date of the operation. And so on throughout all of the 45 columns.

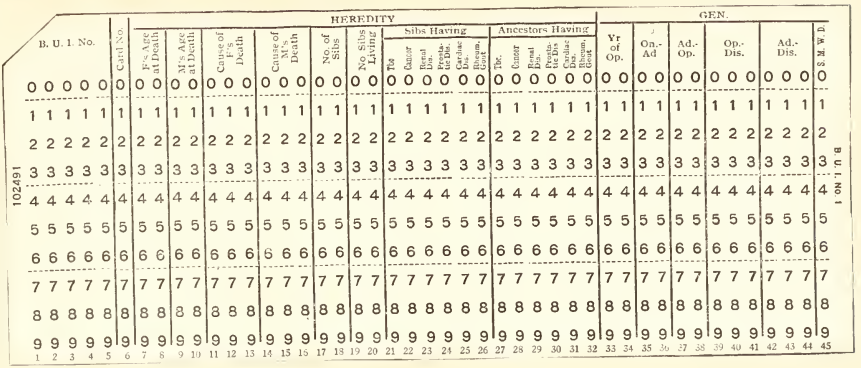
B. U. I. No.
Card No.
HEREDITY
Fs. Age at Death
Ms. Age at Death
Cause of Fs. Death
Cause of Ms. Death
No. of Sibs
No. Sibs Living
Sibs Having
Ancestors Having
Tbc
Cancer
Renal Dis.
Prostate Dis.
Cardiac Dis.
Rheum. Gout
GEN.
Yr of Op.
Op.-Ad.
Ad.-Op.
Op.-Dis.
Ad.-Dis.
S. M. W. D.
B. U. I. No.
102491

Figure 1

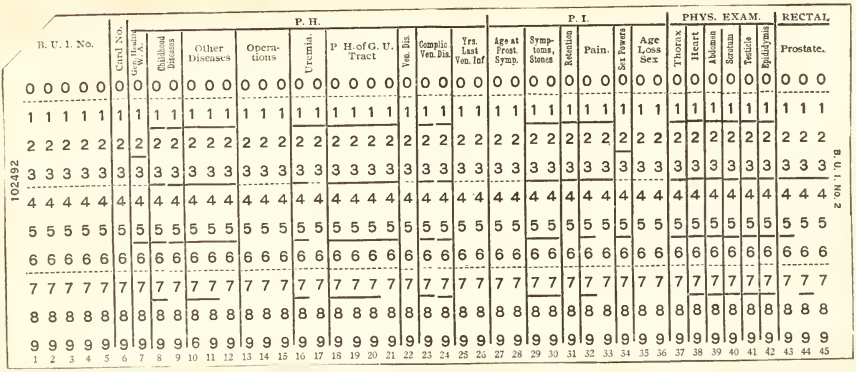
P. H.
P. I.
PHYS. EXAM.
RECTAL
B. U. I. No.
Card No.
Gen. Health W. A.
Childhood Diseases
Other Diseases
Opera-tions
Uremia
P. H. of G. U. Tract
Ven. Dis.
Complic. Ven. Dis.
Yrs. Last Ven. Inf
Age at Front. Symp.
Symp-toms, Stones
Retention
Pain.
Sex Powers
Age Loss Sex
Thorax
Heart
Abdomen
Scrotum
Testicle
Epididymis
Prostate.
102492
B. U. No. 2

Figure 2

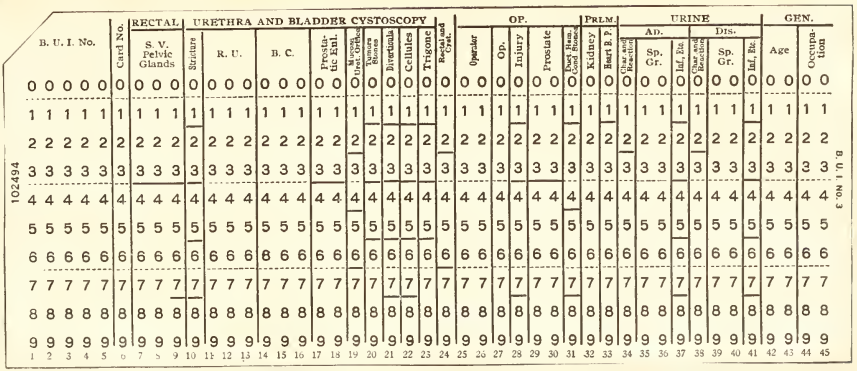
B. U. I. No.
Card No.
RECTAL
S. V. Pelvic Glands
URETHRA AND BLADDER CYSTOSCOPY
Stricture
R. U.
B. C.
Prostatic Enl.
Chronic Urethritis
Stricture
Stones
Diverticula
Cellules
Trigone
Rectal Pal.
OP.
Operator
Op.
Injury
Prostate
Chron. Hem. Cord Stones
PRLM.
Kidney
Bact. B. P.
URINE
AD.
Bact. Acid
Sp. Gr.
Inf. Ele.
DIS.
Bact. Acid
Sp. Gr.
Inf. Ele.
GEN.
Age
Occupation
102494
B. U. I. NO. 3

Figure 3

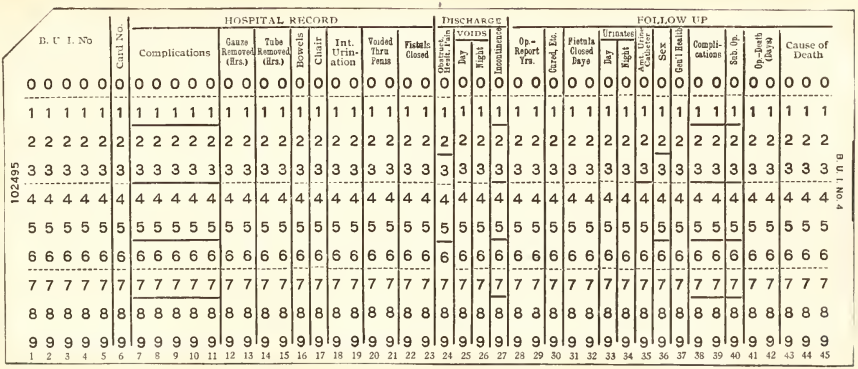
HOSPITAL RECORD
DISCHARGE
FOLLOW UP
B. U. I. No
Card No.
Complications
Gauze Removed (Hrs.)
Tube Removed (Hrs.)
Bowels
Chair
Int. Urination
Voided Thru Penis
Fistula Closed
Obstruction Hemic Pain
VOIDS
Day
Night
Incontinence
Op.-Report Yrs.
Cured, Etc.
Fistula Closed Days
Urinates
Day
Night
Amt. Urine Voided
Sex
Gen'l Health
Compli-cations
Sub. Op.
Op.-Death (Days)
Cause of Death
102495
B. U. I. No. 4

Figure 4

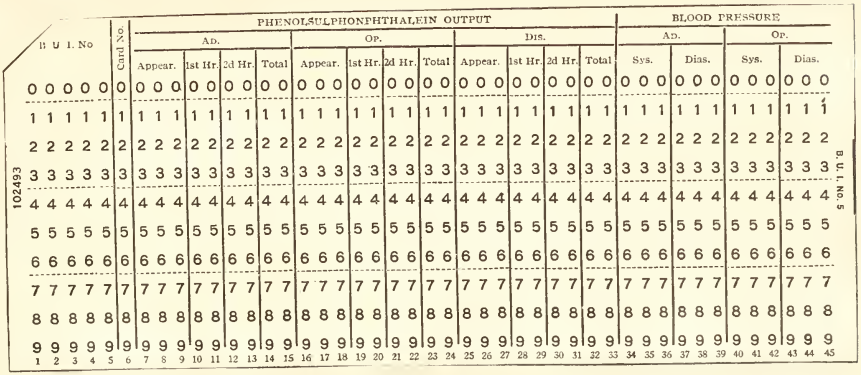

Figure 5

Figs.1-5 Incl.- Facsimiles of card forms for recording in detail case histories of prostatectomy in the Brady Urological Institute.

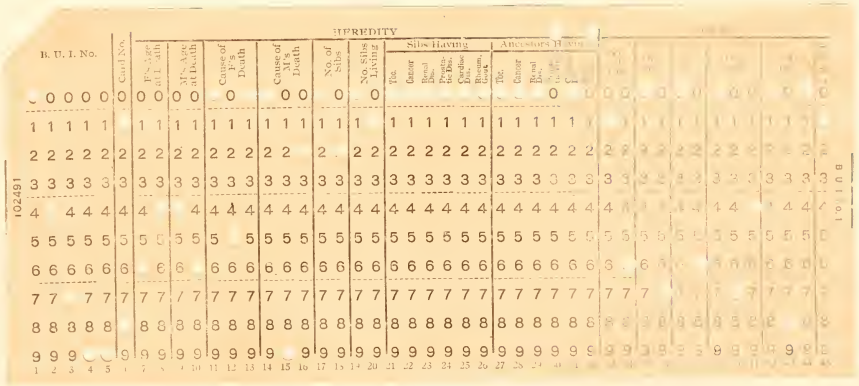

Figure 6: Card No. 1 of case history Brady Urological Institute No. 4799, carrying information regarding heredity, year of operation, onset to admission in years, length of stay in hospital, in days, and social status of patient. Age at death, number of sibs, number of ancestors, onset to admission and length of stay in hospital are punched direct; cause of death and social status are coded, the former according to the International List of Causes of Deaths.

The value of assembling data of this sort on to punch cards is two-fold. Suppose, for example, it was desired to make an extended study of bladder diverticula, a single sort with the sorting machine will separate out all the cases which had diverticula of the bladder from those that did not, and at the same time give the location of the diverticula on the bladder wall. The history numbers can then be got directly from the cards if reference to the history is needed for further facts. In other words, the cards serve the purpose of an elaborate cataloguing system.

A second example drawn from the study made of the etiology of hypertrophy will illustrate another use to which the cards can be put. Suppose the question were asked: "Among those who have a history of infection of the genito-urinary tract, exclusive of venereal disease, age at onset is lower than among those who have not had infections. Has, then, infection anything to do with the age at onset?" If a tabulation of the following sort is set up with a dichotomous arrangement for genito-urinary infections and venereal history and a linear tabulation of age at onset, as shown below, a comparison of the 4 distributions will show whether a correlation between gonorrhoea and genito-urinary infections as secondary complications to gonorrhoea, brought about the lowered age at onset, or whether the difference still exists after gonorrhoea has been removed.

Plan for tabulation of data to be used in a study of the effect of infections of the genito-urinary tract on age at onset of prostatic symptoms.

Infections of genito-urinary tract exclusive of venereal disease.

Age at onset in years	None		Sub Total	Had		Sub Total
	Gonorrhoea only	No venereal		Gonorrhoea only	No venereal	
15-19						
20-29						
25-29						
etc.						

Other similar examples can be thought of, many of them having a more practical value than the one outlined above; for example. the need in some cases for preliminary treatment before operation, the value of the phthalein percentage as an index of the patients condition for operation, the date of closure of fistula in different types of incision used in perineal prostatectomy, etc. Such questions as these have great practical importance, and can at least be answered tentatively by a study of tabulation from punch cards, the sorting and tabulating being a matter of a few hours.

At this point I wish to express my indebtedness to Dr. H. H. Young for his generous cooperation in the free use of the hospital records accorded me, his interest in the work and his helpful advice. The punch cards were prepared, at the suggestion of Dr. Young, for use in a monographic study to be made of prostatic hypertrophy and were loaned to me for the present analysis. To Dr. Lowell J. Reed is due my sincere gratitude for his helpful criticisms

throughout the work as a whole, and to Dr. Raymond Pearl, under whose direction the work was done, a student's appreciation of the opportunity to be guided by his knowledge, experience, enthusiasm and understanding.

2. Historical Account.

Etiology of prostatic hypertrophy has received a fair amount of attention partly from an academic standpoint and partly because theory led to therapeutic practice of vesectomy, etc. But in substance, the state of knowledge regarding it is still as it was in 1905 and, as aptly put by J. B. Deaver, 1905 " among all the heterogeneous and at times bewildering arguments promulgated, one fact is prominently seen, that any solution of the difficulty is not to be looked for in repeating and reiterating the old theories proposed on a priori grounds; . . . . . what is needed is a collective investigation of large groups of cases which have been reported in such detail, and with such completeness that a general view may be had of the type of the enlargement; its duration; the clinical history of the case, including previous local diseases such as gonorrhoea, prostatitis, calculus, etc., and the social habits; as well as a microscopical study of the diseased organ removed either at operation or at autopsy. I am not aware of any such investigations; and as our knowledge is thus unfortunately limited, a satisfactory exposition of the pathology of the prostate gland is a chapter which is still unwritten."

It hadrly seems necessary to review here the older theories of prostatic hypertrophy, they can be found in almost any text book of urology and are very well summarized in Keyes "Urology", 1917 or Lydston 1899. Sir Henry Thompson in "Diseases of the Prostate, etc." 3rd edition, 1868, gives a most excellent account of the views and theories of his predecessors and contemporaries. The views of Dieckhanowski on the role of inflammation in hypertrophy, which

have been supported by Greeh, Brooks, Crandon, Rothschild, Daniel, Herring and others were founded on histological studies, unsupported by clinical histories and on examination mainly of small fibrous prostates. Keyes, 1909, in an analysis of 433 clinical histories was unable to support their histological findings. The concensus of pathologic opinion at present, as given by Pilcher (Abbots Urology, 1918), is that there are three types of prostatic hypertrophy, sclerotic, adenomatous and mixed, to the first of which he ascribes gonorrhoea as a probable cause, and to the second the degenerative processes of old age and the underlying cause of tumor development in general.

B. Discussion of Problem.

A hypertrophied prostate may be made up of an increase in the surface of the secreting gland tissue or of the muscular or connective tissue elements. It is held at present and has been generally supposed for a long time, since approximately the middle of the last century, that the hypertrophy of old age is of the former type and that urinary obstruction in young men, which from histological examination is thought to be inflammatory, perhaps gonorrhoeal in origin, is caused by abnormal growths of the latter sort, i.e., by what is known as a small fibrous enlargement. A fibrous prostate may or may not exhibit increase in gland tissue as well, but a large prostate, for example 100 grams, practically never shows anything but characteristic adenomatous hypertrophy. Microscopical examination has been made of all prostates at Johns Hopkins Hospital and the presence of hyperplasia of the glandular tissue looked for in each specimen. A prostate was included in the present analysis if sections showed the characteristic infolding of the glandular epithelium even though the glandular hypertrophy was relatively smaller in amount than the fibrous increase. When no glandular hypertrophy could be demonstrated

the case was omitted. As the present study is concerned only with benign hypertrophy all cases were excluded from the list of those studied which were diagnosed carcinoma on the basis of a microscopical examination.

Studies of the etiology of benign hypertrophy have been made, based on clinical and histological findings; the present investigation is an attempt to analyze in detail the data pertaining to etiology on histories filed at the Brady Institute and to do it according to modern statistical methods.

Whenever the correlation coefficient has been used it has been calculated by Pearson's formula:

$$r = \frac{\sum f_{xy} - N v_{1x} \cdot v_{1y}}{N \cdot \sigma_x \cdot \sigma_y}$$

The partial correlation coefficient by the formula:

$$r_{12.3456\ldots n} = \frac{r_{12.3456\ldots n-1} - r_{1n.345\ldots n-1} \cdot r_{2n.345\ldots n-1}}{\sqrt{1 - r^2_{1n.345\ldots n-1}} \cdot \sqrt{1 - r^2_{2n.345\ldots n-1}}}$$

χ^2 by the formula:

$$\chi^2 = \sum \left\{ \frac{NN' \left(\frac{f_p}{N} - \frac{f'_p}{N'} \right)^2}{f_p + f'_p} \right\}$$

where f_p and f'_p are pairs of frequencies falling in the same classification unit and from different distributions, N and N' the total frequencies in each distribution and $\sum$, summation;

Contingency coefficient by the formula:

$$C = \sqrt{\frac{\phi^2}{1+\phi^2}} \quad \text{where} \quad \phi^2 = \frac{\chi^2}{N}, \text{ and } \chi^2 = S\frac{(n_{vv} - \nu_{vv})^2}{\nu_{vv}},$$

n_{vv} being the observed frequency in each cell, ν_{vv} the chance number in each cell got by multiplying successively the marginal frequencies of the rows by the marginal frequencies of the columns and dividing the product by N, the total for the entire table; S = summation.

In computing distribution constants Sheppard's corrections have been used if there was high contact at both ends of the curve.

A comparison of two groups of men, the hypertrophy series and a control group drawn from the same age classes but with normal genito-urinary systems would be the best way to come at a study of etiology of hypertrophy. It would be possible then, for example, to predict on the basis of experience in the group of normal men, what would be the expected incidence of gonorrhoea, for example, in the latter group, provided enlarged prostates occurred irrespective of a previous history of gonorrhoea. Any difference between expected and observed incidence of gonorrhoea in the two groups can be thought of as having a casual relationship with the character in respect of which they are known to be different, namely, enlargement of the prostate. Likewise other affections of the genito-urinary tract could be similarly tested. No such control group was available however. Therefore, as a second choice, comparisons have been made between various etiological factors and size of prostate at operation in hospital patients.

The method followed was to divide the entire series into groups on a basis of size, the details of which will be given later, and to examine and compare these in respect to various etiological factors. The question asked

was,"is size of prostate at operation correlated with any of these factors?" or in other words, "is a series of prostates removed from men who have had gonorrhoea previous to the operation different in respect to size from a similar group in which the patients stated they had had no venereal disease?" and so on for a previous history of stone in the bladder or the type of occupation followed, etc. By "weight of prostate", whenever referred to, is meant weight of hypertrophy removed at operation according to the technique for perineal prostatectomy developed by Dr. H. H. Young.

The choice of etiological factors was limited by the information on the individual case histories. This was on the whole adequate so that size of prostate could be correlated with the following classes of information.

1. Age
    a. Age at admission
    b. Age at onset
    c. Onset to admission
2. Venereal History
3. Heredity
    a. Relatives, exclusive of sibs, having certain diseases
       Sibs, including cousins, having certain diseases
    b. Cause of Father's death
       Cause of Mother's death
    c. Father's Age at death
       Mother's Age at death
4. Past History
    a. Genito-urinary tract
    b. Childhood diseases
    c. Some infectious diseases
    d. Occupation

5. Social Status

   a. Reproductive activity of parents

6. Physical examination

   a. Heart

   b. Blood pressure.

Sexual activity of the patient is recognized as bearing a possible relationship with size of prostate and the case histories, especially the "follow up" records from the patients, contain considerable information which can be used in this connection, however it will not be dealt with here but will be made the subject of a separate research to be carried out later.

4. Method of Classification for Size.

Unfortunately the weight, in grams, of the prostate removed at operation has been recorded in less than one-half of the total number of cases, so that the number in which the weight is known is, in some cases, too small to treat statistically when further subdivided. However a rough estimate of size can be obtained by the surgeon's estimate at the time of removal and recorded in the operative note. Consequently the following method was resorted to to divide the material, with respect to size, into, finally, 4 groups.

Enlargement of the prostate occurs usually in the two laterals and the median, and very seldom in the anterior commissure, so infrequently in fact and to so slight a degree when it does occur, that it was disregarded in the classification. Enlargements of the subtrigonal and suburethal lobes, were recorded as median enlargement. So the question is reduced to enlargements of right and left laterals and median. In a large majority, especially of the early histories, the only information regarding this enlargement is the general descriptive term of, small, medium and large, applied to each of the lobes separately. In other histories the size of prostate is estimated in

cm., but this too is estimate not actual measurement. The length, width and thickness are given in cm; for example, the right lobe might be 2-3-1 cm. It was arbitrarily decided to call a volume of 2-2-2 and all sizes under this as "small", 5-5-5 and all over as "large" and all intermediate values as "medium." Of course a lobe may be recorded as having no enlargement which makes a total of four descriptive terms which may be applied to each of these lobes.

Obviously, then, if all of the possible arrangements of sizes of each lobe were represented in the material there would be in all 64 groups, or all the arrangements of the following symbols, using three at a time, where O = no enlargement, S = slight, M = medium, and L = large

Right Lobe	Left Lobe	Median Lobe
O	O	O
S	S	S
M	M	M
L	L	L

So the size of a prostate may be represented by an arrangement of symbols such as M, M, S or M, S, S etc. where the right lobe is understood to stand first in order, the left second and the median third. Some of the combinations such as S, L, S, for example, were not present in the material since they represent combinations of growth of these lobes which do not occur, or occurred so seldom that they were not met with in 836 cases. In 836 cases only were all these lobes described. The combinations that were present, 43 in all, together with their frequencies are as given in Table I.

Table I.- All observed combinations of size of the three main prostatic lobes, with their frequencies.

Slight or no enlargement of lateral or median.		General enlargement		General enlargement Cont'd.		Marked enlargement of laterals; none of median		Marked enlargement of median; none of laterals.	
Symbol Classes	No.	Symbol Classes	No.	Symbol Classes	No.	Symbol Classes	No.	Symbol Classes	No.
0 0 0	1	0 M S	1	M M M	196	S M 0	1	0 0 M	2
0 0 S	4	0 M M	3	M M L	17	M S 0	1	S S L	3
0 S 0	2	S 0 M	1	M L [illegible]	8	M M 0	19	-	-
0 S S	3	S S M	32	M L M	11	M L 0	1	-	-
S 0 0	1	S M S	18	M L L	2	L M 0	1	-	-
S 0 S	6	S M M	24	L 0 M	1	L L 0	2	-	-
S S 0	6	S M L	2	L S M	1	-	-	-	-
S S S	153	S L L	1	L M S	5	-	-	-	-
-	-	M 0 S	1	L H M	7	-	-	-	-
-	-	M 0 M	1	L M L	3	-	-	-	-
-	-	M S S	41	L L S	4	-	-	-	-
-	-	M S M	12	L L M	9	-	-	-	-
-	-	M S L	2	L L L	14	-	-	-	-
-	-	M M S	213	-	-	-	-	-	-
Total	176				630		25		5

It is interesting to note that, quoting from Table I, a very large majority show general enlargement; 176 out of 836 had slight or no enlargement of lateral or median in any combination; 630 had general enlargement, including 32 with small laterals, and medium sized middle lobe; 25 had marked enlargement of laterals and none of the median; while 5 had marked enlargement of median with slight or no enlargement of laterals. If those of only very slight enlargement are subtracted from the total leaving 660, 95 per cent showed general enlargement.

Of the 836 prostates described in the above manner, records of the weight in grams of 476 of them are on the punch cards and 212 of the 476 are described in symbols also. These 212 weights were used for the purpose of further classifying those prostates whose size was known in symbols only. Twenty-five symbol classes were represented in the 212 known weights. The mean weights of these classes are given in Table II and are plotted in Figure 7. It is evident from inspection of the diagram that there is a high degree of correlation between the mean weight of the prostate and the group symbols where these groups are arranged in an ascending order of weight of prostate. Two further facts are brought out (1) that the symbols 0,S,M,L, describing the median, are scattered along the entire axis, and (2) that the laterals are not so distributed but that on the other hand a grouping of the classes on the basis of the laterals alone divides the axis into four logical size groups. Accordingly the median was neglected and the material classified in accordance with the size of laterals alone into four groups including respectively the following symbol combinations, as given in Table II.

Table II.-Typical elements and frequencies of the four main size groups.

Group	Symbol Elements	Total Frequency
I	O O, O S, S O, S S,	24
II	O M, M O, S M, M S, M M.	532
III	O L, L O, S L, L S, M L, L M.	55
IV	L L	34
Total		915

The totals of Tables I and II do not agree, the former being 836, the latter 915, owing to the fact that in 27 histories the size of the laterals was known while that of the median was not. Therefore they could be included in Table II and not in Table I.

Table III.- Mean weight of prostate for each of 25 symbol classes, arranged in ascending order of weight.

Symbol Class	No.	Mean weight in grams.	Symbol Class	No.	Mean weight in grams
S S O	1	3.00	L M M	2	45.00
O O S	3	6.33	M S M	2	45.50
S O S	1	12.00	L S M	1	51.00
S S S	36	14.31	M L M	2	51.50
S M S	2	21.00	M L O	1	57.00
S M M	3	22.67	M L S	4	64.00
S S M	11	24.55	M M L	6	94.50
M M O	7	26.43	L L M	4	108.50
M O S	1	32.00	M L L	2	110.00
M M S	54	32.41	L L S	2	118.00
S S L	1	35.00	L L O	1	125.00
M M M	53	38.74	L L L	6	162.33
M S S	6	43.50	-	-	-
Total				212	

Although cases of marked enlargement of the median with little or no hypertrophy of the laterals are known to occur, weight of prostate is so highly correlated with the estimate of weight based on the laterals alone that the procedure of disregarding the median is thoroughly justified.

Figure 7.- Mean weights of symbol classes arranged in ascending order of weight.

Figures 8 and 9, the former a line diagram of frequency of weight of prostate for the total number, 476; the latter of frequency in the four size groups, show close agreement and so are further proof that the method as adopted classifies the material as to size fairly well. The mode in each diagram falls in the group 20-24. the difference between the means, Table IV, is 1.57 ± 1.96 and between the standard deviations 3.62 ± 1.38. The frequencies plotted in Fig. 9 were computed in the following manner; on the assumption, that the frequencies of each group were samples of a normal distribution, areas were taken from Pearson's Tables, of the normal curve using in each case the mean and standard deviation of the known distributions. Differences between these areas multiplied by the N of each distribution gave the calculated frequency in each unit of grouping. For a more detailed description of the method see Pearson's "Tables for Statisticians and Biometricians" p. XVII ff. This, then, gave four normal curves, overlapping considerably. The area under the curve of the total skew distribution was made equal to the sum of the four normal curves by adding the calculated frequencies in corresponding units, and the curve plotted as in Fig. 9.

Table IV.- Distribution constants for weight of porstate; total and by groups.

	Mean	Standard Deviation	Coefficient of Variation
Total	41.26 ± 1.14	36.85 ± .81	89.30 ± 3.14
Grouped	42.83 ± 1.59	33.22 ± 1.13	77.58 ± 3.90
Difference	1.57 ± 1.96	3.62 ± 1.38	11.72 ± 5.01

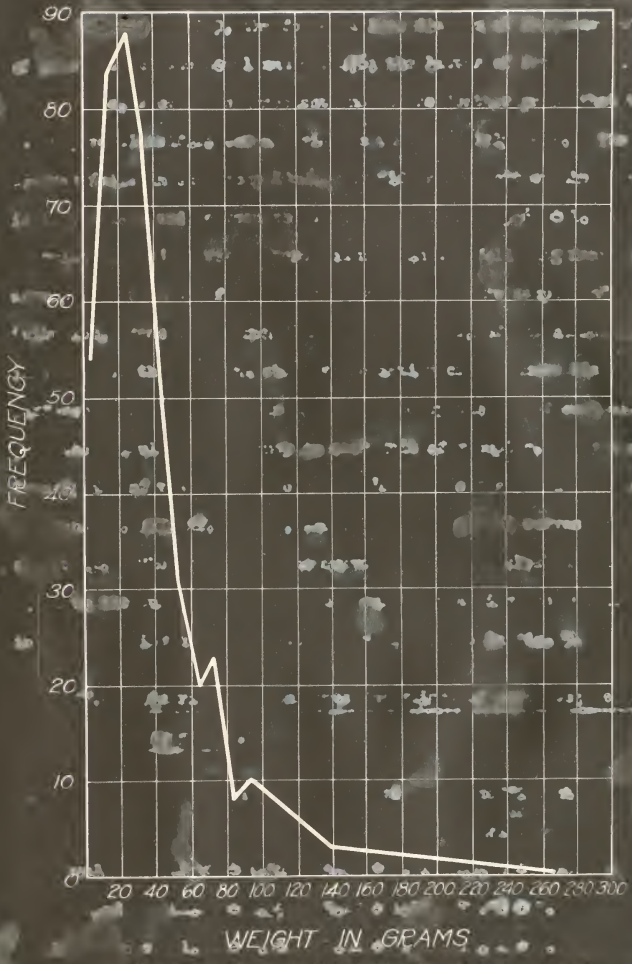

Figure 9.- Frequency distribution for weight in grams of 476 prostates.

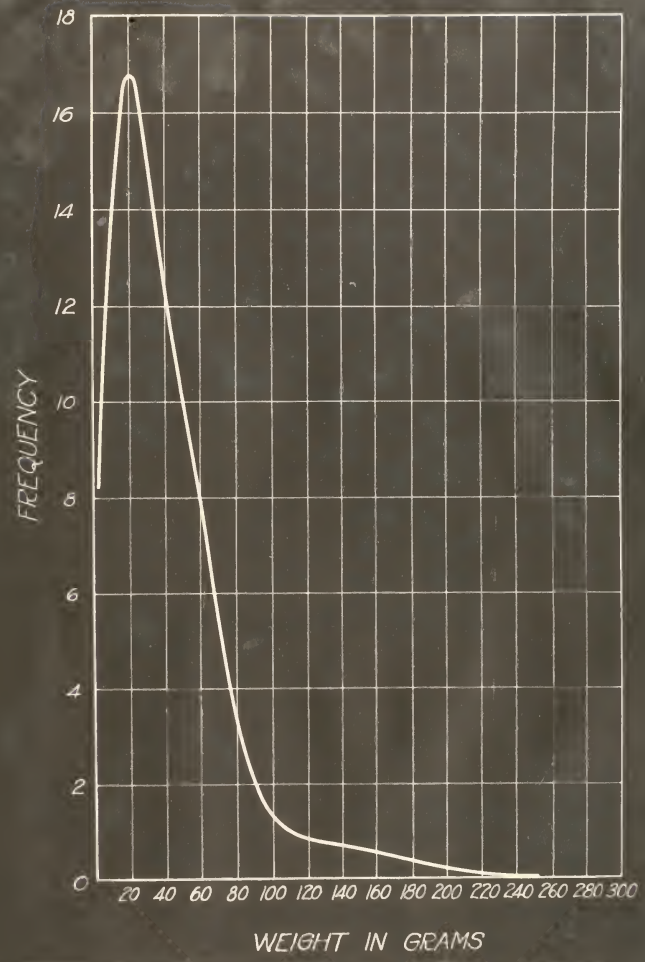

Figure 2.- Frequency distribution for weight calculated from distribution in four size groups.

The above classification into four groups would not have been necessary has all of the 476 cases in which weight was recorded in grams had full information as to the other factors also. So whenever N was reasonably large when drawn from the sample of 476, tables were made from this group instead of from the total number of 836 or rather 915. This was true in all of the age classifications. The advantage in using the smaller sample is that a correlation coefficient, for example between weight of prostate and age at operation, can be computed more readily where the limits of the classes are numerically defined.

5. Prostatic Hypertrophy and Age.

That hypertrophy of the prostate, in some individuals, accompanies old age, that it is one of the degenerative processes characteristic of old age is obvious and well-known. Pilcher (Kelly's Urology, 1918) states that although other factors, some of which he enumerates, may influence growth somewhat, the relationship between hypertrophy and age is the only definite one that can be shown to exist. Thompson, in 1868, records some very interesting observations on the frequency of occurrence of enlarged prostate, and age in relation to hypertrophy. Thompson examined the prostates taken from 164 autopsies of men between the ages of 60-94 years and makes the following statement: "Of 164 individuals ranging between 60 and 94 years of age, in 97 the prostate was unaffected, ... 11 were affected by atrophy and 56 by hypertrophy . . . . . 26 of which weighed 10 drams and upward." Of these 164 cases plus 50 others, the total varying from approximately 50-94 years of age, he says: "The period of life between 55 and 65 is that during which the affection most commonly begins to be developed. I have never been able to meet with an instance of its occurrence at so early a period as 50 years of age.

On the other hand, it appears rarely to commence after 70. Where it exists, the disease has generally made considerable progress before 70 or 85. Consequently, it is met with infrequently in later years, and is exceptional after 80 or 85. It is not altogether unknown, however, few examples having been met with at a much more advanced age."

An analysis of the Johns Hopkins Hospital cases of prostatic hypertrophy would lead to somewhat the same conclusion. Here age, i. e., age at operation and age at onset, have been compared with corresponding weights of prostate in grams. Constants for the distribution of age and weight have been listed in Table V; reference to the table shows that the mean age at operation is 66.72 ± .16 years, age at onset 60.22 ± .20 years, onset to admission 7.43 ± .14 years, and weight of prostate 41.26 ± 1.14 grams. In computing the constants for weight the higher frequencies have been grouped into two large classes, 100-199 and 200-300 respectively; the first centered at 136, the second at 266 grams, the actual centering points of the groups.

Table V.- Constants for age and weight distributions.

Character	No.	Mean	Standard Deviation	Coefficient of Variation
Age at operation	977	66.72 ± .16	7.64 ± .12	11.45 ± .18
Age at onset	939	60.22 ± .20	9.21 ± .14	15.29 ± .24
Onset to admission in years	943	7.43 ± .14	6.48 ± .10	87.25 ± 2.15
Weight of prostate in grams	476	41.26 ± 1.14	36.85 ± .81	89.30 ± 3.14

Correlations of zero and first orders between these four variables, in which age at admission is designated as (1), age at onset as (2), onset to admission as (3), and weight of prostate as (4) show interesting relationships.

All of the coefficients are low but significant. They are given in Tables VI - XI inclusive and the following points may be noted: $r_{41} = .254 \pm .029$ (Table XI) may be interpreted to mean that the older a patient at operation the heavier his prostates; $r_{42} = .166 \pm .031$ that the longer he has had symptoms the heavier his prostate; $r_{12} = .103 \pm .031$ that the older the patient at onset of symptoms the heavier his prostate at operation, or in other words that when onset is early growth takes place more slowly than if onset is at a later age. The coefficient $r_{23} = -.537 \pm .016$ may be interpreted as indicating that the younger the age at onset the longer a patient has symptoms before coming for operation, i. e., it might be argued, as from the above correlation between age at onset and weight of prostate, that if symptoms are initiated early they develop slowly. However it is at once obvious that this high degree of correlation is, partly at least, owing to the fact that age at onset necessarily determines or limits onset to admission, i. e., a patient who has onset at 75 years could not have symptoms over as long a period as one who had an onset at 40 years, so that a negative correlation would result regardless of whether there is any other relationship or not. The first order correlation with weight held constant, $r_{23.4} = -.565 \pm .022$, does not get around the difficulty and still leaves in doubt the question as to whether there is any correlation here or not or whether the value of the coefficient is entirely determined by the above relationship. The coefficient $r_{12.3} = .230 \pm .030$ i. e., the correlation between age at onset and weight of prostate for a constant onset to admission strengthens the idea that growth in early age groups is slow as compared with that in later ages.

Table VI.- Age at operation and weight of prostate at operation.

Age in years	Weight in grams												
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
20-24	1	-	-	-	-	-	-	-	-	-	-	-	1
25-29	-	-	-	-	-	-	-	-	-	-	-	-	-
30-34	-	-	-	-	-	-	-	-	-	-	-	-	-
35-39	-	-	-	-	-	-	-	-	-	-	-	-	-
40-44	-	-	-	-	-	-	-	-	-	-	-	-	-
45-49	1	-	-	-	-	-	-	-	-	-	-	-	1
50-54	9	10	4	4	1	-	-	-	1	-	-	-	29
55-59	15	15	10	6	3	4	-	-	-	-	3	-	56
60-64	6	18	21	19	14	6	4	6	2	-	3	-	99
65-69	12	24	26	12	14	7	7	8	3	3	12	-	128
70-74	7	11	16	22	11	8	4	5	1	4	6	1	96
75-79	3	4	9	9	4	4	4	3	1	3	2	1	47
80-84	-	2	2	4	2	2	-	1	-	-	2	1	16
90-94	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	54	84	88	77	49	31	19	23	8	10	28	3	474

Table VII.- Age at onset of symptoms and weight of prostate at operation

Age in years	Weight in grams												
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
15-19	1	-	-	1	-	-	-	-	-	-	-	-	2
20-24	-	-	-	-	-	-	-	-	-	-	-	-	-
25-29	-	-	-	-	-	-	-	-	-	-	-	-	-
30-34	2	-	1	-	-	-	-	-	-	-	-	-	3
35-39	-	-	-	-	-	1	-	1	-	-	-	-	2
40-44	3	5	1	1	1	-	-	-	-	-	-	-	11
45-49	5	10	5	6	1	1	1	-	1	1	1	-	32
50-54	13	14	11	6	5	2	2	4	-	1	4	-	62
55-59	10	17	21	14	12	9	7	6	-	2	9	-	107
60-64	7	15	19	19	11	5	6	5	4	2	8	2	103
65-69	8	11	18	8	9	4	2	3	1	2	3	1	70
70-74	2	4	7	15	5	8	1	2	-	-	-	-	44
75-79	2	-	3	2	3	1	-	-	-	1	2	-	14
80-84	-	1	-	2	-	-	-	-	-	-	-	-	3
Total	53	77	86	74	47	31	19	21	6	9	27	3	453

Table VIII.- Onset to admission in years, and weight of prostate at operation.

Onset to admission	Weight in grams												
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
0- 1	14	18	10	8	9	2	1	-	1	2	1	-	66
2- 3	9	13	25	20	10	12	2	6	1	-	4	-	102
4- 5	13	13	15	14	13	3	2	3	3	2	5	-	90
6- 7	4	10	9	8	6	2	2	1	-	-	3	-	45
8- 9	2	3	3	5	2	1	1	4	-	1	3	1	26
10-11	5	8	13	10	2	1	5	3	-	2	4	1	54
12-13	1	2	2	2	2	-	3	1	1	-	1	-	15
14-15	2	4	4	4	1	2	1	-	-	-	4	-	22
16-17	-	-	-	-	1	1	-	1	-	1	-	-	4
18-19	-	2	1	-	-	-	-	-	-	-	1	-	4
20-21	2	3	4	1	1	1	1	1	-	1	-	1	16
22-23	-	1	-	-	-	-	-	-	-	-	-	-	1
24-25	-	-	-	1	-	1	-	1	-	-	1	-	4
26-27	-	1	-	-	-	-	-	-	-	-	-	-	1
30-31	1	-	-	-	-	-	1	-	-	1	-	-	3
36-37	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	53	78	86	74	47	31	19	21	6	9	27	3	454

Table IX.- Age at operation and onset to admission in years.

Onset to Admission in Years	Age at operation in years												
	20-24	35-39	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	Total
0- 1	-	-	-	7	20	39	31	26	13	3	1	-	140
2- 3	-	-	1	11	41	39	49	42	25	3	-	-	211
4- 5	-	1	1	14	28	38	40	27	27	5	-	-	181
6- 7	1	-	-	6	12	25	24	16	10	-	-	-	94
8- 9	-	-	1	1	6	7	21	9	5	-	-	-	50
10-11	-	-	-	4	5	19	38	27	9	4	-	1	110
12-13	-	-	-	-	4	6	6	14	4	2	-	-	36
14-15	-	-	2	1	6	10	6	9	3	4	-	-	41
16-17	-	-	-	-	1	-	1	-	2	1	-	-	5
18-19	-	-	-	-	1	-	2	3	2	1	-	-	9
20-21	-	-	-	3	1	4	3	12	5	1	-	-	34
22-23	-	-	-	-	-	1	-	2	-	-	-	-	3
24-25	-	-	-	-	-	3	-	3	-	1	-	-	7
26-27	-	-	-	-	-	-	-	1	1	-	-	-	2
28-29	-	-	-	-	1	-	-	-	-	-	-	-	1
30-31	-	-	-	-	-	2	-	1	2	-	-	-	5
32-33	-	-	-	-	-	-	-	1	-	-	-	-	1
36-37	-	-	-	-	1	-	-	-	-	-	-	-	1
50-51	-	-	-	-	-	-	-	1	-	-	-	-	1
Total	1	1	5	47	130	193	226	194	108	25	1	1	932

Table X.- Age at onset of symptoms and onset to admission in years.

Onset to Admission	Age at onset															
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	Total
0 - 1	-	-	-	-	-	-	-	9	24	37	30	23	12	3	1	139
2 - 3	-	1	-	-	-	-	3	26	40	42	49	37	11	1	-	210
4 - 5	-	-	-	1	-	1	14	24	41	38	26	29	7	-	-	181
6 - 7	1	-	-	-	-	-	7	16	29	20	16	5	-	-	-	94
8 - 9	-	-	-	-	1	1	4	7	18	12	6	1	-	-	-	50
10 -11	-	-	-	-	-	4	8	19	38	28	8	4	-	1	-	110
12 -13	-	-	-	-	-	1	6	5	9	10	3	2	-	-	-	36
14 -15	-	-	-	2	1	4	11	6	10	3	4	-	-	-	-	41
16 -17	-	-	-	-	1	-	-	1	1	2	-	-	-	-	-	5
18 -19	-	-	-	-	1	-	1	3	2	2	-	-	-	-	-	9
20 -21	-	-	1	2	1	4	8	12	5	1	-	-	-	-	-	34
22 -23	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	3
24 -25	-	-	-	-	3	-	3	-	1	-	-	-	-	-	-	7
26 -27	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	2
28 -29	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
30 -31	-	-	-	2	-	1	2	-	-	-	-	-	-	-	-	5
32 -33	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
36 -37	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
50 -51	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	2	2	2	7	8	19	67	131	218	195	142	101	30	5	1	930

Table XI.- Zero and first order correlation coefficients for age and weight of prostate.

Characters	No.	Correlation Coefficient.
Weight of prostate and age at operation	474	$r_{41} = +.254 \pm .029$
Weight of prostate and age at onset	452	$r_{42} = +.103 \pm .031$
Weight of prostate and onset to admission	454	$r_{43} = +.166 \pm .031$
Age at operation and onset to admission	932	$r_{13} = +.126 \pm .022$
Age at onset and onset to admission	930	$r_{23} = -.537 \pm .016$
Weight of prostate and age at operation for constant onset to admission.	454	$r_{41.3} = +.238 \pm .030$
Weight of prostate and onset to admission for constant age at admission.	454	$r_{43.1} = +.140 \pm .031$
Weight of prostate and onset to admission for constant age at onset.	454	$r_{43.2} = +.263 \pm .029$
Age at operation and onset to admission for constant weight of prostate.	454	$r_{13.4} = +.088 \pm .031$
Weight of prostate and age at onset for constant onset to admission.	454	$r_{42.3} = +.230 \pm .030$
Age at onset and onset to admission for constant weight of prostate.	454	$r_{23.4} = -.565 \pm .022$

Subscripts

1 = Age at operation

2 = Age at onset of symptoms

3 = Onset to admission

4 = Weight of prostate

In order to test the observation made by Thompson in the quotation given above, i. e., whether hypertrophy is not so likely to occur in very old age groups as is true in very young groups, incidence rates based on the age at onset for the Johns Hopkins Hospital material and the population of the United States for 1910 and specific for age were computed. Also the age specific death rates from prostatic disease using an average number of deaths over the 10 years 1910-1919, inclusive, were used as a check and comparison. These rates are listed in Table XII. Reference to the table shows that in both cases the rates decrease in the upper age groups indicating that prostatic hypertrophy is not as likely to occur or to be a cause of death after a certain age period has been passed. Chances of getting prostatic symptoms are, roughly, best between the ages of 55 and 75, are gradually rising before 55 and falling off after 75. This conclusion could scarcely be based on the hospital material alone for the older a man is the less apt is he to travel some distance for an operation and so the frequencies in the older age groups would be reduced somewhat for that reason, but the deaths in the registration area are not open to that criticism and they point to the same conclusion.

To summarize, the Johns Hopkins Hospital cases when analyzed lead to the three following conclusions as to the relationship between age and prostatic hypertrophy.

(1) Since prostates are larger the older the patient at operation and the longer he has had symptoms, it is concluded that age has something to do with size of prostate.

(2) As death rates and incidence rates rise to a maximum with age and then start to decline again there is obviously an age period beyond which chances of getting hypertrophy grow less.

(3) That growth of the prostate is slow if onset occurs comparatively early in life is indicated as a possible conclusion to be drawn

from the positive correlation between weight of prostate and age at onset.

Table XII.- Incidence rates for prostatic hypertrophy, Johns Hopkins Hospital series; and age specific death rates from prostatic disease.

Age	Incidence rates per 100,000 based on male population in the United States, 1910, and age at onset, Johns Hopkins Hospital series.	Death rate per 100,000 based on male population of the United States, 1910, and deaths from prostatic disease, 1910-1919 divided by 10.
15-19	.044	.027
20-24	.044	.079
25-29	.047	.111
30-34	.191	.109
35-39	.267	.258
40-44	.682	.456
45-49	2.816	1.185
50-54	6.256	2.391
55-59	14.713	8.227
60-64	16.611	21.459
65-69	16.551	48.067
70-74	18.379	99.761
75-79	9.358	172.271
80-84	3.252	272.269
85-89	1.775	348.096
90-94	-	359.376
95-99	-	395.419
100-104	-	123.188

The regression line of growth on age, or the mean weight for each age period, is plotted in Figure 10. Since regression is not linear and since the points (throughout that portion at least where they are based on adequate observations,) do follow quite consistently, the general outline of an autocatalytic growth curve, a curve of this type was fitted to the observed means, and is the solid line of Figure 10. The curve fits the points remarkably well; it must be remembered that the number of observations that go to determine the last two points are 16 and 1 respectively. The observed means with their frequencies and the calculated points are given in Table XIII.

The equation:

$$y = \frac{b}{e^{-ax} + c}$$

was fitted empirically, i. e., put through 3 points, y_1, y_2, y_3 chosen from the general trend, and the constants a, b and c calculated from the formulae:

$$\frac{b}{c} = \frac{2\, y_1 y_2 y_3 - y_2^2 (y_1 + y_3)}{y_1 y_3 - y_2^2}$$

$$a = \log_{10} \frac{y_2 \left(\frac{b}{c} - y_1\right)}{y_1 \left(\frac{b}{c} - y_2\right)} \div h \log_{10} e$$

$$c = \frac{1}{y_2 - y_1} \left(\frac{y_1}{e^{a\alpha}} - \frac{y_2}{e^{a(\alpha+h)}} \right)$$

$$b = \frac{b}{c} \cdot c$$

where α = value of 1st point

h = distance between points

y_1, y_2, y_3 = ordinates of points

A discussion of this curve by Dr. R. Pearl and Dr. L. J. Reed, can be found in Proceedings of National Academy of Sciences, Vol. 6, June, 1920, pp. 275-288.

The growth curve of Fig. 10 is necessarily based on statistical averages, i. e., it is not constructed from consecutive weighings of the same prostate but like population growth curves is an average of many curves of the same general type and starting from various points on the abscissal axis. In regard to this latter point it was decided that as the statement of age at onset must necessarily vary with individuals, that weight plotted against onset to admission in years, while it might have certain advantages, would give no better idea of growth than weight and age at operation does.

Figure 10, then, shows that prostates get heavier with age, that regression is not linear, but that the main growing period is between 45 and 75 years approximately, and that both before and after those ages growth is retarded.

Table XIII.- Mean weight of prostate for age groups, and calculated points on a growth curve fitted to the means.

Age	No.	Observed mean weight in grams	Calculated points
22.5	1	5.00	.17
35	-	-	1.28
40	-	-	2.83
45	-	-	6.03
47.5	1	5.00	9.61
52.5	29	19.48	16.24
57.5	56	27.20	26.56
62.5	99	37.76	36.82
67.5	120	44.78	44.33
72.5	96	46.74	48.69
77.5	47	51.23	50.89
82.5	16	64.56	51.91
85	-	-	52.19
92.5	1	35.00	52.58

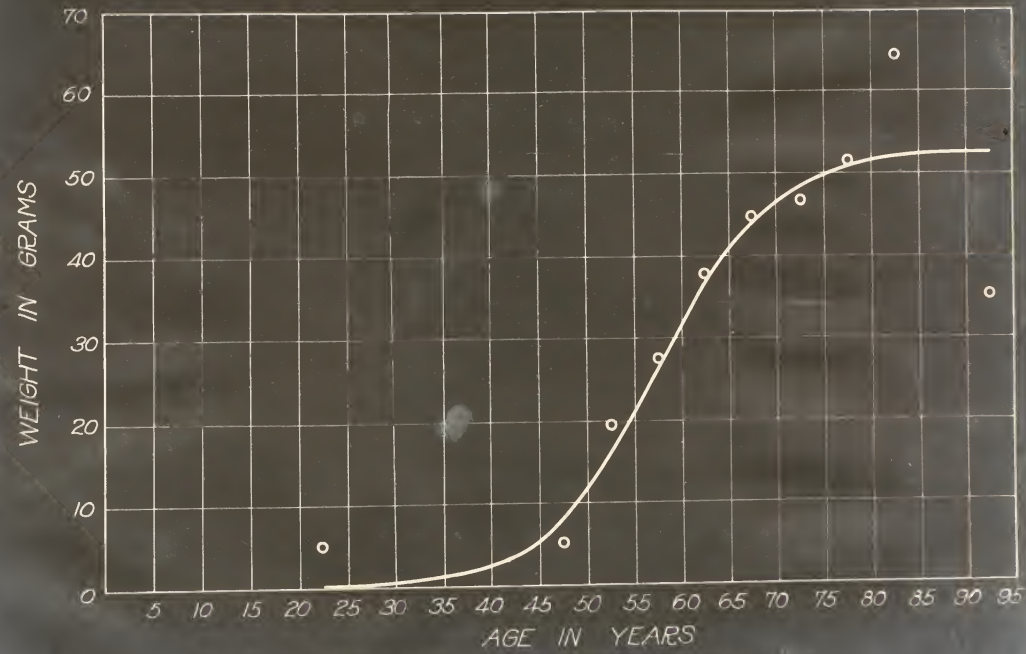

Figure 10.- Autocatylitic growth curve fitted to regression of weight on age.

6. Prostatic Hypertrophy and Venereal History.

In analyzing venereal history in relation to hypertrophy the distributions "no venereal" and "gonorrhoea only" are the only ones large enough for statistical treatment so that in reality only gonorrhoea has been dealt with. The constants for the distribution "syphilis only" have been computed (See Table XV) and show no significant differences from those of "no venereal", but the numbers are too small in the one group to base any conclusion on.

Of the 997 histories examined, 596 had no venereal history, 254 gonorrhoea only, 47 gonorrhoea and some other complicating venereal disease or a total of 301 out of 921, an incidence rate of 32.68 per 100. These figures are taken from Table XIV. In inferring from this rate the incidence of gonorrhoea in the general population two facts must be remembered, namely; (1) if the conclusion based on the analysis to follow is correct, the hospital group dealt with has been somewhat selected for gonorrhoea, a fact which would increase the incidence of gonorrhoea over that of the general population; (2) since the hospital records are the patient's statement of facts in his "past history" which occurred usually about 25-40 years previous to his admission to the hospital, his carelessness or any desire to misrepresent the truth would tend to lower the incidence rate of gonorrhoea from its real value. As these two factors operate in opposite directions the above rate may not be so far from representing the condition in the general population.

Table XIV.- Percentage distribution of patients with venereal history.

Venereal disease	No.	Per cent
No information	76	-
No venereal	596	61.71
Gonorrhoea only	254	27.58
Gonorrhoea and some other venereal disease	47	5.10
Some other venereal	24	2.61
Total	997	

A past history of gonorrhoea has an undoubted effect upon weight of prostate at operation and likewise upon age at operation and age at onset of prostatic symptoms. Table IV shows that the mean weight of the prostate of those who have had gonorrhoea is 31.65 ± 2.27 grams, 10.31 ± 2.74 grams lighter than those who have no venereal history. Onset of symptoms is 2.13 ± .50 years earlier in the gonorrhoea than in the "no venereal" group and age at operation is 1.92 ± .42 years earlier.

Table XV.--Distribution constants of age and weight of prostate for venereal history.

Distribution	Constant	No.	Syphilis only	No.	No venereal	No.	Gonorrhoea only	Difference between constants for "no venereal" and "gonorrhoea only."
Age at operation	Mean	21	66.67 ± .89	580	67.04 ± .20	234	65.22 ± .37	1.82 ± .42
	Standard deviation		6.03 ± .63		7.13 ± .14		8.70 ± .26	1.58 ± .30
	Coefficient of variation		9.13 ± .96		10.63 ± .21		13.35 ± .41	2.72 ± .46
Age at onset	Mean	20	61.25 ±1.22	576	60.62 ± .25	240	58.49 ± .43	2.13 ± .50
	Standard deviation		5.07 ± .86		8.73 ± .17		10.13 ± .31	1.40 ± .35
	Coefficient of variation		13.17 ±1.43		14.41 ± .29		17.33 ± .54	2.92 ± .62
Onset-admission	Mean	20	6.00 ± .50	578	7.24 ± .17	248	7.96 ± .31	.72 ± .36
	Standard deviation		3.31 ± .35		6.24 ± .12		7.33 ± .22	1.10 ± .25
	Coefficient of variation.		66.18 ±9.67		86.13 ± 2.69		92.10 ±4.58	5.97 ± 5.31
Weight	Mean		---	284	45.46 ± 1.52	123	34.65 ±2.27	10.81 ± 2.74
	Standard deviation		---		38.08 ± 1.08		37.37 ±1.61	.71 ± 1.93
	Coefficient of variation		---		83.75 ± 3.67		107.84 ±6.46	24.09 ± 9.22

The details of the computation of χ^2 for the two distributions for weight of prostate in the group "gonorrhoea only" and "no venereal" are shown in Table XVI. In all succeeding instances of the calculation of χ^2, only the distributions will be given with the row corresponding to row 6 of Table XVI, and the values of χ^2 and P. The value of P in Table XVI, .006, shows that in 1000 random samplings only 6 of them would be as dissimilar as these, a good enough basis for the belief that the distributions of Table XVI are different. The percentage distributions, rows 4 and 5 with their differences in row 6 of Table XVI shows an excess of small prostates in the gonorrhoea group, or there is a negative correlation between gonorrhoea and weight of prostate.

Table XVII shows that the probability that distributions for age at onset are dissimilar, is only 16 in 100, but in all likelihood they can be safely regarded as really different, especially since the percentage of cases in the lower age group is consistently higher in "gonorrhoea only" than in "no venereal" and correspondingly lower in the higher age groups. The same is true for age at operation. Onset to admission, the distributions for which are given in Table XVII, is apparently not influenced by gonorrhoea; there is no significant difference between the means (Table XV) and χ^2 shows 62 chances in 100 in favor of getting distributions as different as these on chance alone.

If gonorrhoea produces inflammatory changes in the prostate, which in turn cause symptoms of obstruction complicating the hypertrophy present, a result similar to the one obtained might be expected, namely an earlier onset of symptoms and a lighter prostate among those who have had gonorrhoea. In the absence of knowledge as to the degree of inflammatory change in prostates when there is a past history of gonorrhoea, it can only be inferred that there is some such complication, from the fact that prostates are on the whole de-

sidedly smaller at operation if the patient has had gonorrhoea, and therefore another factor must have been partly responsible for the symptoms previous to operation. Gonorrhoea then cannot be shown to have anything to do with hypertrophy of the prostate, in fact gonorrhoea is negatively correlated with hypertrophy and with age at onset, and at operation. The gonorrhoea group differs then from a "no venereal" in having a lower age at operation and at onset of symptoms and a lighter prostate, facts which would suggest a complication due to gonorrhoea.

Table XVI.- Computation of χ^2 for distributions of weight of prostate in the groups "no venereal" and "gonorrhoea only"

Weight of prostate in grams	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
1. No venereal, f	24	42	49	49	34	20	12	21	6	5	20	2	284
2. Gonorrhoea only, f'	26	25	22	17	10	7	5	-	1	3	6	1	123
3. f + f'	50	67	71	66	44	27	17	21	7	8	26	3	-
4. f/N	.0845	.1479	.1725	.1725	.1197	.0704	.0423	.0739	.0211	.0176	.0704	.0070	.9998
5. f'/N'	.2114	.2033	.1789	.1382	.0813	.0569	.0407	.0000	.0081	.0244	.0488	.0081	1.0001
6. $f/N - f'/N'$	-.1269	-.0554	-.0063	.0343	.0384	.0135	.0016	.0739	.0130	-.0068	.0216	-.0011	
7. $(f/N - f'/N')^2$	.0161	.0031	.0000	.0012	.0015	.0002	.0000	.0055	.0002	.0000	.0005	.0000	
8. $\frac{(f/N - f'/N')^2}{f + f'}$	.00032	.00005	.00000	.00002	.00003	.00001	.00000	.00026	.00002	.00001	.00002	.00000	.0007352

$\chi^2 = 284 \times 123 \times .0007352 = 25.68 \qquad P = .006$

f denotes the frequency in one unit grouping for weight and f^1 the corresponding frequency for the othe r distri- . butions. N and N^1 the respective totals. In computing χ^2 six decimal places had been kept thrpughout.

Table XVII.- Probability that "no venereal" and "gonorrhoea only" are alike in their age distribution.

Age at operation	Under 45	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	90-95	Total
No venereal	-	2	30	71	130	145	133	67	16	-	594
Gonorrhoea only	3	4	16	49	46	59	47	24	5	1	254
Difference between percent distribution	-.0118	-.0124	-.0125	-.0734	.0378	.0118	.0389	.0183	.0072	-.0039	
χ^2 = 24.02 P = .004											

Age at onset	Under 30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	
No venereal	2	4	4	9	41	82	122	137	89	62	22	2	576
Gonorrhoea only	4	3	4	7	22	35	65	45	35	20	6	2	248
Difference between percent distribution	-.0126	-.0052	-.0092	-.0126	-.0175	.0012	-.0503	.0564	.0134	.0270	.0140	-.0046	
χ^2 = 15.64 P = .16													

Onset-admission	0-1	2-3	4-5	6-7	8-9	10-14	10-19	20-24	25-29	30-34	35-39	50-54	
No venereal	87	140	108	59	29	94	29	22	6	4	-	-	578
Gonorrhoea only	38	46	52	25	15	38	16	11	3	2	1	1	248
Difference between percent distribution	-.0027	.0567	-.0228	.0013	-.0103	.0094	-.0143	-.0063	-.0017	-.0011	-.0040	-.0040	
χ^2 = 8.97 P = .62													

7. Prostatic Hypertrophy and Heredity.

That prostatic hypertrophy is highly correlated with age and that longevity is a characteristic which is inherited are factors which may possibly be responsible for the apparent heredity of prostatic hypertrophy. Hospital histories so often lack the data necessary for a study of heredity that the available facts are scanty and inadequate. However three types of correlation have been set up, i. e., (1) number of relatives having certain diseases and size of prostate; (2) cause of parents death and size of prostate; and (3) age of parents at death with size of prostate and with age at onset of symptoms.

Table XVIII.- Distribution for size of prostate in groups with and without a history of certain diseases in the family and the probability that the pairs of distributions are samples of the same universe.

Size of prostate	Group I	Group II	Group III	Group IV	Total
No history of tuberculosis among relatives.	171	420	40	25	656
Had history of tuberculosis among relatives	27	46	2	1	76
Difference between per cent distribution.	-.0946	.0350	.0347	.0250	
$\chi^2 = 5.01$ P = .17					
No history of cancer among relatives.	183	432	41	27	683
Had history of cancer among relatives	16	47	3	0	66
Difference between per cent distribution.	.0255	-.0796	.0146	.0395	
$\chi^2 = 3.57$ P = .31					
No history of renal diseases among relatives	148	367	40	19	574
Had history of renal diseases among relatives	10	33	0	2	35
Differebce between per cent distribution.	-.0270	-.0178	.0697	-.0240	
$\chi^2 = 3.11$ P = .38					
No history of prostatic disease among relatives	124	317	30	15	486
Had history of prostatic disease among relatives	13	32	8	3	56
Difference between per cent distribution.	.0230	.0808	-.0811	-.0227	
$\chi^2 = 6.11$ P = .11					
No history of organic heart disease among relatives	107	253	31	16	407
Had history of organic heart disease among relatives	14	18	2	1	35
Difference between per cent distribution.	-.1371	.1073	.0190	.0107	
$\chi^2 = 3.07$ P = .38					

Classification for size of prostate has been made according to the method outlined in a previous section. "Relatives" in each case is exclusive of sibs and cousins.

χ^2 for the first pair of distributions of Table XVIII, size of prostate and relatives, exclusive of sibs and cousins, having tuberculosis, shows a negative correlation, not large. The chances are 17 in 100 in favor of as large a difference on chance alone. Although there is probably a slight correlation here, the relationship is not necessarily causal although it may be. But age is known to be correlated with size of prostate and the emphasis may be upon the fact that those who have lived to the age when they are apt to have developed a fair sized prostate are not the ones who have a history of tuberculosis in their families, rather than that a history of tuberculosis in the family makes it less likely for a prostate to grow to a large size. It is impossible to eliminate age from the above comparison owing to the small size of the sample.

The probability is 11 in 100 for the 4th pair of distributions of Table XVIII, i. e., size of prostate and a history of prostatic disease in the family, so there is a low positive correlation between the characters. Therefore if there is a history of prostatic disease in the family, in other words if the patient's ancestors lived to be old men, old enough to have markedly enlarged prostates, their sons and grandsons are likely also to live long enough to develop large prostates.

The remaining three pairs of distributions of Table XVIII, cancer, renal disease and organic heart show no correlation with size of prostate and the character named. If the χ^2 test is applied to distributions of size of prostate for patients with sibs, including cousins, having and not having had tuberculosis, cancer, renal disease, prostatic disease and heart disease, no differences between the pairs of distributions are found, as seen in Table XIX.

Table XIX.- Distribution for size of prostate in groups with and without a history of certain diseases among the patient's sibs, and the probability that the pairs of distributions are samples of the same universe.

Size of prostate	Group I	Group II	Group III	Group IV	Total
No history of tuberculosis among sibs.	174	427	39	25	665
Had history of tuberculosis among sibs	29	67	8	2	106
Difference between per cent distribution	-.0119	.0100	-.0168	.0187	
χ^2 = 1.40 P = .71					
No history of cancer among sibs	190	452	43	27	712
Had history of cancer among sibs	15	35	4	1	55
Difference between per cent distribution.	-.0059	-.0015	-.0123	.0197	
χ^2 = .68 P = .80					
No history of renal disease among sibs	164	394	42	19	619
Had history of renal disease among sibs	6	12	1	0	19
Difference between per cent distribution.	-.0508	.0049	.0152	.0307	
χ^2 = .83 P = .80					
No history of prostatic disease among sibs	159	384	37	15	595
Had history of prostatic disease among sibs	6	26	1	2	35
Difference between per cent distribution.	.0958	-.0075	.0336	-.0319	
χ^2 = 3.51 P = .33					
No history of organic heart among sibs	131	296	34	16	477
Had history of organic heart among sibs	7	12	0	0	19
Difference between per cent distribution.	-.0230	-.0110	.0713	.0335	
χ^2 = 2.57 P = .46					

Classification for size of prostate has been made according to the method outlined in a previous chapter. Cousins are included among sibs.

Distribution for weight of prostate when father's cause of death fell under the classification "General" or "Genito-urinary diseases" of the International List of Causes of Death and mother's cause of death under "General" or "Senility" had been compared by means of χ^2 and the distribution constants computed. In "General" is included mainly tuberculosis and cancer. It is doubtful if any conclusions can rightfully be drawn from the distributions, the numbers are too small, but they are included here as of possible interest. All other causes of death included entirely too few cases to be considered. The examination of Table XX shows that the difference between the mean weights of prostates of patients whose fathers died of "General" and "Genito-urinary" diseases are possibly different, the difference being barely three times the probable error of the difference. There is no difference between mean weights of prostates of patients whose mothers died of "General" causes and "Senility". χ^2 for these distributions in Table XXI shows the same thing; a possible difference between the weight distributions for "General" and "Genito-urinary" as cause of fathers death and not between "General" and "Senility" as cause of mothers death. In Table XXI P = .07 in the former comparison and P = .37 in the latter. This would indicate that perhaps age is not alone responsible for the apparent heredity of prostatic hypertrophy, but by no means proves it.

Table XX.- Distribution constants of weight of prostate for different causes of death of parents.

Cause of parents death	No.	Mean	Standard Deviation	Coefficient of Variation
Father: General	31	33.74 ± 3.46	28.60 ± 2.45	84.75 ± 11.73
Father: Genito-urinary	32	51.69 ± 4.54	38.08 ± 3.21	73.67 ± 8.97
Mother: General	49	37.67 ± 2.81	29.19 ± 1.99	77.48 ± 7.83
Mother: Senility	26	41.23 ± 4.29	32.46 ± 3.04	78.72 ± 11.02
Differences				
Father: (Genito-urinary) - General		17.95 ± 5.71	9.48 ± 4.04	11.09 ± 14.45
Mother: Senility - General		3.56 ± 5.13	3.27 ± 3.63	1.21 ± 13.52

Table XXI.- Probability that distribution for weight of prostate is the same for different causes of death of parents.

Size of prostate	Group I	Group II	Group III	Group IV	Total
Cause of father's death					
General	25	42	1	1	69
Genito-urinary	13	36	6	2	57
Difference between per cent distribution.	.1342	-.2229	-.0908	-.0206	
$\chi^2 = 7.08$ P = .07					
Cause of mother's death					
General	25	67	5	0	97
Senility	21	34	4	0	59
Difference between per cent distribution.	-.0982	.1145	-.0163		
$\chi^2 = 2.11$ P = .37					

Parents' age at death, as might be expected, is not correlated with weight of prostate or with age at onset of symptoms. These correlation tables comprise Tables XXII - XXV with the correlation coefficients given in Table XXVI.

It is concluded from the above that heredity as a factor in prostatic hypertrophy is not understood, and the scarcity of information pertaining to it in the Johns Hopkins Hospital histories makes it impossible to determine at present whether the normal age incidence of the disease is entirely responsible for the apparent heredity of hypertrophy or not.

Table XXII.- Father's age at death and weight of prostate at operation.

Fathers Age at Death	Weight of prostate in grams												
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
30-34	1	-	1	-	-	-	-	-	-	-	-	-	2
35-39	1	-	-	-	-	-	-	-	-	-	-	-	1
40-44	-	1	-	-	-	2	-	-	-	-	-	-	3
45-49	1	1	-	-	2	-	-	1	-	-	4	-	9
50-54	-	1	1	1	-	3	-	-	-	-	-	-	6
55-59	1	4	2	1	-	-	1	-	1	-	1	-	11
60-64	1	3	2	4	1	-	-	-	-	-	1	-	12
65-69	1	-	3	2	1	1	-	-	-	-	-	-	8
70-74	3	2	1	3	2	2	-	-	2	-	2	-	17
75-79	2	3	3	1	3	1	1	1	-	-	-	-	15
80-84	-	6	5	1	5	2	1	1	-	2	2	-	25
85-89	-	2	-	1	-	1	1	-	-	-	-	-	5
90-94	-	1	1	1	-	-	-	-	-	1	1	-	5
Total	11	24	19	15	14	12	4	3	3	3	11	-	119

Table XXIII.- Mother's age at death and weight of prostate at operation.

Mothers Age At Death	Weight of prostate in grams											
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	Total
25-29	2	-	1	-	-	-	-	-	-	-	-	3
30-34	1	1	1	1	-	-	-	-	-	-	1	5
35-39	1	-	1	1	-	1	-	-	-	2	-	6
40-44	-	1	1	2	-	1	-	-	-	-	-	5
45-49	-	1	-	-	1	-	-	-	-	-	1	3
50-54	-	1	1	-	1	2	1	-	-	-	2	8
55-59	2	1	-	-	1	-	-	-	-	-	1	5
60-64	-	-	-	2	2	-	-	-	-	1	1	6
65-69	4	3	2	2	-	-	-	-	1	-	1	13
70-74	-	2	1	2	3	2	-	1	-	-	1	12
75-79	1	4	5	2	2	2	1	1	-	-	-	18
80-84	-	2	1	3	-	2	-	1	-	-	-	9
85-89	1	4	-	-	2	-	-	-	-	-	2	9
90-94	-	2	1	1	-	1	1	-	-	-	-	6
Total	12	22	15	16	12	11	3	3	1	3	10	108

Table XXIV.- Father's age at death and age at onset of symptoms.

Father's Age At Death	Age at onset.										
	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	Total
30-34	-	-	-	-	2	-	1	-	1	-	4
35-39	-	-	-	-	3	1	-	2	-	-	6
40-44	-	-	-	2	-	-	2	2	-	-	6
45-49	-	-	-	1	4	1	1	-	1	-	11
50-54	-	-	2	2	2	4	3	-	1	-	14
55-59	-	1	3	3	3	3	3	1	-	-	17
60-64	1	1	3	3	3	6	-	1	-	1	19
65-69	-	-	2	4	2	1	2	8	2	-	21
70-74	-	1	-	9	11	12	5	9	-	-	47
75-79	1	-	2	8	10	7	5	2	1	-	36
80-84	-	3	2	2	16	9	8	3	2	1	46
85-89	-	-	3	2	6	2	4	2	-	-	19
90-94	-	-	2	1	4	1	4	-	-	-	12
Total	2	6	19	40	66	47	38	30	8	2	258

Table XXV.- Mother's age at death and age at onset of symptoms.

Mothers Age at Death	Age at onset												
	20-24	25-29	30-34	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	Total
20-24	-	-	-	-	-	-	-	1	-	-	-	-	1
25-29	-	-	-	-	-	1	1	1	2	1	-	-	6
30-34	-	-	-	-	3	-	3	-	3	1	-	-	10
35-39	-	-	-	-	-	2	2	-	1	1	1	1	8
40-44	1	-	-	-	1	-	3	3	1	-	-	-	9
45-49	-	-	-	1	1	4	1	2	1	-	-	-	10
50-54	-	-	-	-	-	2	-	6	1	2	1	-	12
55-59	-	-	-	1	2	-	2	2	3	1	-	-	11
60-64	-	-	-	-	1	6	5	2	3	1	1	-	19
65-69	-	1	1	1	2	7	8	5	5	2	1	-	33
70-74	-	1	-	1	1	4	7	4	1	5	1	-	25
75-79	-	-	-	1	2	4	11	10	5	2	1	-	36
80-84	-	-	-	-	2	3	7	7	5	5	1	1	31
85-89	-	-	-	1	2	2	3	1	5	6	-	-	20
90-94	-	-	-	-	-	2	3	1	3	2	-	1	12
95-99	-	-	-	-	-	-	2	-	-	-	-	-	2
Total	1	2	1	6	17	37	58	45	39	29	7	3	245

Table XXVI.- Correlation coefficients for parents age at death and weight of prostate and age at onset of symptoms.

Character	Coefficient of Correlation
Father's age at death and weight of prostate	-.007 ± .062
Mother's age at death and weight of prostate	-.054 ± .065
Father's age at death and age at onset	-.034 ± .042
Mother's age at death and age at onset	+.079 ± .043

B. Prostatic Hypertrophy and Social Status.

Among the Johns Hopkins Hospital cases of prostatic hypertrophy there are undoubtedly fewer single men than would be expected on the basis of the 1910 census. Examination of Table XXVII shows that out of 278 patients 51 were single and 45 years of age or over and 227 had been married at some time and were also 45 years or more. The expected number of single men, where P, the expectation that the next man picked at random will be single, is based on the male population 45 years and over in the United States in 1910, is almost twice as great as the actual number, 90 as against 51. If σ is calculated from the formula $\sigma = \sqrt{npq}$, $\frac{d}{\sigma} = 4.35$ or the probability of a difference as large as the actual one, 39, would be expected 7 times in a million random samplings of the same population. And so it can be concluded that the hospital experience is not a random sample of the population but has relatively more married men than the United States as a whole and of the same age groups.

Table XXVII.- Actual number of single men among the Johns Hopkins Hospital series compared with the expected number of single men based on the male population of the United States, 45 years and over, in 1910.

Johns Hopkins Hospital 45 years and over			1910 Census of Population 45 years and over		Expected Number of single men	Difference	$\frac{d}{\sigma}$	P
Single	Married Widowed Divorced	Total	Single	Total				
51	927	978	2,6023	91,9303	90	39	1.35	.0000068

Correlations of social status with age at operation, age at onset, onset to admission and weight of prostate have been made but do not lead to definite conclusions, owing mainly to the small size of the single group, 51 individuals. Constants for the above distributions and values of P based on χ^2 are given in Tables XXVIII, XXIX, and XXX.

Table XXVIII.- Constants for age and weight of prostate, of distributions classified for social status; patients 45 years and over at operation.

Character	No.	Mean	Standard Deviation	Coefficient of Variation
Age at operation				
Single	51	66.13 ± .66	7.00 ± .47	10.58 ± .71
Married	760	65.99 ± .18	7.24 ± .13	10.97 ± .19
Widowed and Divorced	163	70.97 ± .35	6.57 ± .25	9.25 ± .35
Age at onset				
Single	47	58.14 ± .94	9.60 ± .67	16.52 ± 1.18
Married	718	59.71 ± .22	8.86 ± .16	14.83 ± .27
Widowed and divorced	157	63.96 ± .49	9.02 ± .34	14.11 ± .55
Onset to admission				
Single	48	8.19 ± .65	6.71 ± .46	81.98 ± 8.64
Married	722	7.24 ± .16	6.41 ± .11	88.59 ± 2.52
Widowed and divorced	157	7.39 ± .36	6.64 ± .25	84.22 ± 4.98
Weight of prostate				
Single	27	34.30 ± 3.65	28.14 ± 2.58	82.06 ± 11.54
Married	376	42.23 ± 1.34	38.66 ± .95	91.54 ± 3.68
Widowed and divorced	69	39.67 ± 2.37	29.17 ± 1.67	73.53 ± 6.09

An examination of Table XXVIII with the differences in Table XXIX shows that between single and married men there is no difference in age at operation, age at onset, onset to admission or weight of prostate. The mean for weight of prostate among single men however is based on only 27 individuals, and so does not mean much. The mean age at operation and at onset of symptoms for widowed and divorced are higher than the same means for married,

as would be expected owing to the necessary difference in age distribution of the two. Onset to admission and weight of prostate are the same in the two groups.

Table XXIX.- Differences, with their probable errors, between constants of Table XXVIII.

Character	Difference Between Mean	Difference between Standard Deviation	Difference between Coefficient of Variation
Age at operation			
Married-single	.12 ± .68	.24 ± .48	.39 ± .74
Widowed and divorced-married	1.97 ± .39	.67 ± .28	1.72 ± .40
Age at onset			
Married-single	1.57 ± .97	.74 ± .69	1.68 ± 1.21
Widowed and divorced-married	4.26 ± .53	.17 ± .38	.73 ± .61
Onset to admission			
Single-married	.95 ± .67	.97 ± .53	2.24 ± 2.97
Widowed and divorced-married	.65 ± .39	.23 ± .28	4.38 ± 5.59
Weight of prostate			
Married-single	7.93 ± 3.99	10.51 ± 2.75	9.48 ±12.11
Married-widowed-divorced	2.56 ± 2.72	9.49 ± 1.93	18.01 ± 7.12

Table XXX shows the following: distribution for age at operation, and onset to admission is undoubtedly the same for single and married men. Age at onset is perhaps slightly different among single and married, P =.12, the heavier prostates being among the married; the mean however (Table XXVIII) shows no difference that is significant. Weight of prostate has been classified in groups since 49 individuals could be included by this method

instead of only the 27 on which the means were based. The probability that distributions for weight of prostate are different between single and married is, P = .26, based on 49 individuals. This value is on the borderline, it certainly cannot be said with any degree of certainty that the distributions are different and yet a value of .26 with the percentage of heavy prostates consistentlyhigher among themarried than the single leaves a question as to what a larger experience would show. Married and widowed are undoubtedly different in distribution for age at operation and at onset of symptoms, as would be expected, while they are distributed alike with respect to onset to admission and weight of prostate.

Table XXX.- Probabilities that single, married, widowed and divorced are distributed alike as to age and size of prostate.

Age at operation	35-39	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	Total
Single	-	1	3	5	10	20	6	5	1	-	-	51
Married	-	5	46	119	173	182	145	76	13	1	-	760
Difference between percent distribution.	-	.0130	-.0017	-.0585	-.0316	.1527	-.0731	-.0020	.0025	-.0013	-	
χ^2 = 8.31 P = .43												
Married	1	5	46	119	173	182	145	76	13	1	-	761
Widowed and divorced	-	-	1	9	22	34	51	35	10	-	1	163
Difference between percent distribution	.0013	.0066	.0543	.1012	.0924	.0306	-.1223	-.1149	-.0443	.0013	-.0061	
χ^2 = 64.61 P = .000000												

Table XXX (Continued)

Age at onset	Under 30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70 and over	Total
Single	1	1	1	2	3	5	3	16	8	2	47
Married	3	5	7	16	55	107	185	145	101	94	718
Difference between percent distribution	.0171	.0143	.0115	.0203	-.0128	-.0426	-.0874	.1385	.0295	-.0884	
χ^2 = 13.96 P = .12											

Age at onset	30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80 and over	
Married	3	5	7	16	55	107	185	145	101	72	18	4	718
Widowed & divorced	1	-	-	1	8	17	21	33	32	29	13	2	157
Difference between percent distribution	-.0022	.0070	.0097	.0159	.0256	.0407	.1239	-.0082	-.0632	-.0844	-.0577	-.0072	
χ^2 = 40.00 P = .000036													

Onset to admission	0-1	2-3	4-5	6-7	8-9	10-14	15-19	20-24	25-54	Tota
Single	7	10	9	4	2	8	3	5	-	48
Married	111	169	140	75	41	112	36	24	14	722
Difference between percent distribution	-.0079	-.0257	-.0064	-.0205	-.0151	.0115	.0126	.0709	-.0194	

χ^2 = 7.65 P = .43

Onset to admission	0-1	2-3	4-5	6-7	8-9	10-14	15-19	20-24	25-29	30-34	35-39	50-54	
Married	111	169	140	75	41	112	36	24	7	5	1	1	722
Widowed & divorced	24	30	33	13	7	31	7	8	3	1	-	-	157
Difference between percent distribution	.0009	.0430	-.0163	.0211	.0122	-.0423	.0476	-.0177	-.0094	.0006	.0014	.0014	

χ^2 = 12.10 P = .36

Size of prostate	Group I	Group II	Group III	Group IV	
Single	19	27	2	1	49
Married	185	451	45	28	709
Difference between percent distribution	.1268	-.0851	-.0227	-.0191	

χ^2 = 4.08 P = .26

Married	185	451	45	28	709
Widowed and divorced	35	97	7	5	144
Difference between percent distribution	.0179	-.0375	.0149	.0048	

χ^2 = .91 P = .80

All under 45 years at operation have been omitted from the distribution for age at operation, age at onset of symptoms and size of prostate for comparisons of single and married.

As to social status then as a factor in the etiology of hypertrophy of the prostate, the only fact that is clear is that the proportion of married men among the Johns Hopkins Hospital cases is larger than is to be expected from the experience of the 1910 census; but whether married men have on the average later age at onset of symptoms and heavier prostates than single men, while age at operation is the same in each, is perhaps indicated as possible but by no means proved.

Number of sibs has been used as an index of the reproductive activity of the patient's parents. Table XXXI gives the mean number of sibs in each of the four classes made on the basis of size of prostate, and the differences, in the same table, are scarcely larger than their probable errors. In so far then as number of children is a criterion, there is no relationship between size of prostate and parents reproductive activity.

Table XXXI.- Distribution constants, with differences, for number of sibs in classification for size of prostate.

Group	No.	Mean	Standard Deviation	Coefficient of Variation
I	77	5.21 ± .21	2.75 ± .15	52.71 ± 3.57
II	152	5.28 ± .17	3.09 ± .12	58.49 ± 2.94
III and IV	14	6.14 ± .55	3.08 ± .39	50.09 ± 7.82
Differences				
I - II		.07 ± .27	.34 ± .19	5.78 ± 4.62
I - (III and IV)		.94 ± .59	.33 ± .42	2.62 ± 8.60
II - (III and IV)		.87 ± .58	.01 ± .41	8.40 ± 8.36

9. Prostatic Hypertrophy and Past History.

Affections of the genito-urinary tract, enumerated in full in Table XXXII are not frequent being mainly infections of the bladder and epididymis due to catheterization, stricture as a complication following gonorrhoea, and bladder stone. The 65 cases of Table XXXII of infection of bladder refer to acute infection and not merely to infected urine, and unless otherwise stated in the table all headings include the present illness as well as the period prior to onset.

Table XXXII.- Table of the affections of the genito-urinary tract, exclusive of "present illness" recorded on 997 histories of prostatic hypertrophy at the Johns Hopkins Hospital.

Pathological condition	No.
Infection of the bladder	65
Infection of kidney	10
Infection of prostate	16
Infection of epididymis and testis	177
Infection of penis and perineum	8
Stones	87
Complete retention prior to onset	14
"Slight diffisulty since childhood" - prior to onset	57
Stricture	45
Hematuria, prior to onset	78
Incontinence, prior to onset	9
Varicocele	4
Brights	1
Injury to scrotum	1
Testicle tuberculous	1
Tumor of testicle	1
Bladder tumor	2
Undescended testicle	2

Weight of prostate and age at onset appear to be effected by a history of some previous genito-urinary disease, but this is apparently due to the correlation between gonorrhoea and infections of the genito-urinary tract, stricture, etc. The constants of Table XXXIII show that age at onset is

significantly lower among those with a genito-urinary history, but that the mean weight in the two groups is the same. In Table XXXIV the probability that the distributions of weight of prostate are alike is .09, or there is a slight negative correlation between weight of prostate and genito-urinary affections. The same was found to be true of gonorrhoea. When those who have genito-urinary history are divided into "no venereal" and "gonorrhoea only" there is still a difference between those with no history of a genito-urinary disease and the "gonorrhoea only" part of those with a genito-urinary history, but no difference between the former and the "no venereal" group. The constants for these distributions are given in Table XXXIII where it is seen that the difference between the mean weight of prostate among those with no past history of the genito-urinary tract and those with "gonorrhoea only" and a past history of some genito-urinary disease is $1^{g}.07 \pm 3.01$ grams. and between those with "no venereal" and a past history of some genito-urinary disease is 6.95 ± 3.43 grams. Consequently it would seem as though the correlation with gonorrhoea caused the apparent effect of a history of some genito-urinary disease upon the weight of prostate and age at onset of symptoms.

A small percentage of the total number of case histories has recorded whether or not the patient has had the common childhood diseases, namely, scarlet fever, diphtheria, measles, chickenpox, whooping cough and mumps. The χ^2 test was applied to each of the pairs of distributions, i. e., of those of whom it was definitely stated that they had not had measles, for example, and those who had. The values of P are presented in Table XXXV from which it is seen that scarlet fever differs from the other diseases in having a probability of only .08 that the distributions are two samples of the same distribution, a low enough probability to be called slightly significant. The correlation is positive, i. e., there is an excess of small prostates among those who have not had scarlet fever. Table XXXVI shows

that mean weights based on 56 and 95 individuals are not significantly different however. Age at operation for those who have had and not had scarlet fever is the same; 66 years for each. Why scarlet fever should be correlated with size of prostate, or whether it is or not, is not clear, and the meagerness of the sample makes it impossible to form an opinion on either point.

Infections of later life, typhoid, pneumonia and malaria likewise show no correlation with size of prostate as seen in Table XXXVII.

With respect to alcohol, the histories were divided into two groups, those who used it and those who stated they had never been accustomed to drink. These distributions are given in Table XXXVIII. The probability that these two distributions are different is .6, or about certainty that they are random samples of the same distribution, so that the use of alcohol is not correlated with size of prostate at operation.

Table XXXIII.- Distribution constants, with their differences, of age and weight of prostate for past history of the genito-urinary tract.

Character	No.	Mean	Standard Deviation	Coefficient of Variation
Age at onset				
1 No past history of genito-urinary tract	593	61.08 ± .25	8.98 ± .18	14.69 ± .29
2 Had past history of genito-urinary tract — Total	344	58.68 ± .34	9.38 ± .24	15.99 ± .42
3 Had past history of genito-urinary tract — No venereal	196	59.89 ± .40	9.06 ± .28	13.15 ± .48
4 Had past history of genito-urinary tract — Gonorrhoea only	109	59.57 ± .70	10.82 ± .49	19.48 ± .92
Onset to admission				
5 No past history of genito-urinary tract	593	7.18 ± .19	6.35 ± .12	88.47 ± 2.77
6 Had past history of genito-urinary tract — Total	344	7.92 ± .24	6.68 ± .17	84.24 ± 3.37
7 Had past history of genito-urinary tract — No venereal	196	7.71 ± .30	5.79 ± .21	77.67 ± 4.03
8 Had past history of genito-urinary tract — Gonorrhoea only	109	9.28 ± .51	7.91 ± .36	85.64 ± 7.35
Weight of prostate				
9 No past history of genito-urinary tract	297	41.63 ±1.42	36.27 ±1.00	87.13 ± 3.83
10 Had past history of genito-urinary tract — Total	165	41.27 ±2.03	38.62 ±1.43	91.03 ± 5.81
11 Had past history of genito-urinary tract — No venereal	86	48.38 ±2.12	42.92 ±1.21	98.34 ± 7.27
12 Had past history of genito-urinary tract — Gonorrhoea only	54	30.56 ±3.65	28.89 ±1.87	101.16 ±11.46
Differences				
Age at onset				
(1) - (2)	2.41 ± .42	.11 ± .30	1.30 ± .51	
(1) - (3)	1.19 ± .47	.92 ± .33	1.24 ± .56	
(1) - (4)	5.51 ± .74	1.85 ± .52	4.78 ± .97	
Onset to admission				
(5) - (6)	.75 ± .30	.32 ± .21	4.23 ± 4.36	
(5) - (7)	.53 ± .34	.36 ± .24	10.80 ± 4.99	
(5) - (8)	1.10 ± .54	1.56 ± .38	7.17 ± 7.85	
Weight of prostate				
(9) - (10)	.36 ± 2.42	2.35 ± 1.75	6.89 ± 6.96	
(9) - (11)	6.75 ± 3.43	6.64 ± 2.42	1.21 ± 8.20	
(9) - (12)	13.07 ± 3.91	7.39 ± 2.13	14.02 ±12.08	

Table XXXIV.- Probability that distribution of weight of prostate is the same with and without a past history of some disease of the genito-urinary tract.

Weight of prostate	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
No past history of genito-urinary tract	24	53	60	53	35	18	9	16	5	5	17	2	297
Had past history of genito-urinary tract	30	25	26	23	13	13	10	6	3	4	11	1	165
Difference between percent distribution	-.1010	.0269	.0444	.0391	.0391	-.0182	-.0303	.0175	-.0013	-.0074	-.0094	.0007	

$\chi^2 = 17.49$ P = .09

Table XXXV - Probability that those who have not had and those who have had certain childhood diseases are distributed alike for size of prostate.

Size of prostate	Group I	Group II	Group III	Group IV	Total
Scarlet fever					
None	73	129	15	5	222
Had	30	71	5	[illegible]	100
Difference between percent distribution	.1234	-.1289	.0176	-.0175	
χ^2 = 6.9[illegible] P = .08					
Diphtheria					
None	67	126	12	5	210
Had	1	27	4	0	32
Difference between percent distribution	-.0818	.0808	-.0198	.0239	
χ^2 = 2.36 P = .41					
Measles					
None	20	33	3	0	56
Had	72	159	15	5	251
Difference between percent distribution	.0703	-.0[illegible]42	-.0062	-.0199	
χ^2 = 2.0[illegible] P = .57					
Chickenpox					
None	32	53	5	1	91
Had	13	35	2	2	52
Difference between percent distribution	.1016	-.0907	.0165	-.0275	
χ^2 = 2.90 P = .41					
Whooping cough					
None	28	51	5	2	86
Had	41	74	11	3	129
Difference between percent distribution	.0078	.0194	-.0271	.0000	
χ^2 = .55 P = .80					
Mumps					
None	26	49	3	2	80
Had	70	137	14	7	228
Difference between percent distribution	.0180	.0116	-.0239	-.0057	
χ^2 = .75 P = .80					

Table XXXVI.- Distribution constants of age and weight for those who have had and not had scarlet fever.

Character	No.	Mean	Standard Deviation	Coefficient of Variation
Age at operation				
No scarlet fever	235	66.41 ± .37	8.49 ± .26	12.79 ± .40
Had scarlet fever	112	66.25 ± .47	7.41 ± .33	11.18 ± .51
Weight of prostate				
No scarlet fever	95	38.73 ± 2.18	31.52 ± 1.54	81.39 ± 6.07
Had scarlet fever	56	33.77 ± 2.03	22.53 ± 1.44	66.71 ± 5.34

Differences			
Age at operation			
No scarlet fever - had scarlet fever	.16 ± .60	1.09 ± .43	1.61 ± .65
Weight of prostate			
No scarlet fever - had scarlet fever	4.96 ± 2.98	8.99 ± 2.11	14.68 ± 8.43

Table XXXVII.- Probability that those who have had and not had certain infectious diseases are distributed alike for size of prostate.

Size of prostate	Group I	Group II	Group III	Group IV	Total
Typhoid					
None	119	283	27	21	450
Had	61	131	15	4	211
Difference between per cent distribution	-.0247	.0080	-.0111	.0277	
χ^2 = 3.53 P = .33					
Pneumonia					
None	129	303	35	19	486
Had	33	62	2	3	100
Difference between per cent distribution	-.0646	.0035	.0520	.0091	
χ^2 = 4.99 P = .17					
Malaria					
None	92	209	27	9	337
Had	34	81	8	6	129
Difference between per cent distribution	.0094	-.0077	.0181	-.0198	
χ^2 = 1.58 P = .66					

Table XXXVIII.- Probability that those who used and who did not use alcohol are distributed alike for size of prostate.

Size of prostate	Group I	Group II	Group III	Group IV	Total
Alcohol					
Used	59	141	13	6	219
Did not use	62	123	8	4	197
Difference between per cent distribution	-.0453	.0195	.0188	.0071	
χ^2 = 1.73 P = .64					

Occupations were classified under the rather inclusive headings of Table CXXIX, namely, agricultural, professional, trade and domestic service, industries and transportation and outdoor laborers; and correlated with size of prostate. The contingency coefficient calculated by the usual method, is .097, or the probability that their distribution is different from a chance one is .99. Therefore it must be concluded that, with the grouping used, type of occupation is not associated with size of prostate.

Table XXXIX.- Occupation and weight of prostate.

	Weight of prostate				
Occupation	Group I	Group II	Group III	Group IV	Total
Agricultural	33	97	12	4	146
Professional	58	145	12	7	222
Trade, domestic and personal service	98	193	16	11	318
Industries and transportation	24	51	4	3	82
Outdoor laborers	8	23	4	1	36
Total	221	509	48	26	804
$\chi^2 = 7.70$ P = .99 C = .097					

Since sedentary habits as a result of certain occupations have been claimed to influence growth of the prostate a classification of occupations was made on that basis and the distribution for weight of prostate compared in the two types of occupation, sedentary and active. Table XL gives in detail the occupations grouped as sedentary and active. Agricultural, professional and merchant classes include the bulk of the frequency. The constants for these distributions (Table XLI), and χ^2 (Table XLII) show that the difference between the mean is less than the probable error of the difference and P = .93. Or the conclusion is drawn that, with the above classification of occupations at any rate, there is not the slightest evidence of any difference in weight of prostate between groups of men whose occupations require sedentary habits and those who lead a more active life.,

Table XL.- Occupations classified as sedentary and active.

Occupation	No.
Sedentary	
Clergymen	21
Teachers and college professor	12
Journalists	4
Lawyers	29
Officials (city, state, government)	1
Bankers and brokers	15
Bookkeepers and accountants	7
Office work, clerks, stenographers	8
Boot and shoe makers	3
Active	
Agricultural pursuits	68
Dentists, physicians, civil engineers, surveyors	16
Boarding house and restaurant keepers	2
Janitors, watchmen, policemen	3
Soldiers, sailors, marines	5
Agents, commercial travelers	10
Merchants and dealers	104
Foremen, overseers salesmen, porters	11
Hostlers and livery stable keepers	4
Railroad employees, outside work	6
Carpenters, masons, painters, glaziers, printers	10
Millers	2
Iron and steel workers and machinists	2
Coal miners	5
Lumbermen	3
Ranchers	2
Laborers	6

Table XLI.- Distribution constants of weight of prostate for sedentary and active types of occupation.

Occupation	No.	Mean	Standard Deviation	Coefficient of Variation
Sedentary	100	42.96 ± 2.56	38.00 ± 1.81	88.46 ± 6.76
Active	292	41.85 ± 1.50	38.01 ± 1.06	90.81 ± 4.13
Differences				
Sedentary - active		1.11 ± 2.97	.004 ± 2.10	2.35 ± 7.92

Table XLII.- Probability that distribution for weight of prostate is the same among those pursuing sedentary and active occupations.

Weight of prostate	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
Occupation													
Sedentary	10	13	22	16	12	8	3	6	1	3	5	1	100
Active	34	54	49	47	33	16	13	14	5	6	19	2	292
Difference between percent distribution	-.0164	-.0549	.0522	-.0010	.0070	.0252	-.0145	.0121	-.0071	.0095	-.0151	.0032	

$\chi^2 = 4.93$ P = .93

10. Prostatic Hypertrophy and Heart and Blood Pressure.

In the routine physical examination given patients on admission to the hospital an examination of the heart is made and this was recorded in detail on the punch cards because of the role heart condition plays in operative risks. Because it is possible to conceive that blood pressure and the general heart condition might cause abnormal development in some part of the body, blood pressure and heart condition have been correlated with weight of prostate.

Three divisions have been recognized in classification of heart condition (1) negative (2) slight disorders, such as slight enlargement, murmurs, slight pulse inequalities, and (3) a diagnosis of definite myocarditis. Table XLIII gives the probabilities that the three groups are alike in distribution of weight of prostate; since P = .17 when (1) and (2) are compared and .07 when (1) and (3) are contrasted, the distributions are probably slightly different, and the heavier prostate associated with heart abnormalities. Age distributionsfor the same groups, but drawn from the total number of cases, were set up and the constants for these are given in Table XLIV. It is clear from this table that the differences between the mean ages of each of the groups taken in pairs are significant. Therefore, is the association of size and heart disorder due to the association of size and age and heart trouble and age? To answer this question the equivalent of regression lines for size on age, or the mean weight for each age group, were constructed for the groups "negative" and "enlarged", etc. only, "myocarditis" not containing sufficient individuals for analysis. Since regression of weight on age is non-linear the parabolic growth curve was fitted to these series of means as described in an earlier section. Table XLV gives these means and the calculated points, and Figure 11 the plotted curves. It is evident from an inspection of these curves that when age is held constant there is no difference in mean weight

of prostate in the two groups. And therefore heart abnormalities do not seem to be associated with weight of prostate.

Table XLIII.- Probability that groups with different heart conditions are alike in distribution of size of prostate.

Size of prostate	Group I	Group II	Group III	Group IV	Total
Heart					
Negative	121	248	20	17	406
Enlarged, etc.	99	265	28	12	404
Difference between percent distribution	.0530	-.0451	-.0220	.0192	
χ^2 = 4.95 P = .17					
Negative	121	248	20	17	406
Myocarditis	6	29	5	2	42
Difference between percent distribution	.1552	-.0796	-.0624	-.0037	
χ^2 = 6.37 P = .07					

Table XLIV.- Constants of age distribution in three heart groups.

Heart	No.	Mean	Standard Deviation	Coefficient of Variation
Negative	433	65.49 ± .26	7.93 ± .19	12.11 ± .28
Enlarged, etc.	437	67.58 ± .24	7.35 ± .17	10.88 ± .25
Myocarditis	47	68.95 ± .70	7.06 ± .49	10.10 ± .71
Differences				
Negative-enlarged, etc.		2.09 ± .35	.58 ± .25	1.24 ± .38
Negative-myocarditis		4.46 ± .74	.87 ± .52	2.01 ± .76
Enlarged, etc-myocarditis		2.37 ± .73	.29 ± .52	.78 ± .75

Table XLV.- Mean weight of prostate by age in two heart groups and calculated points on the curve fitted to the means.

Age	Heart-Negative			Heart - Enlarged, etc.		
	No.	Mean weight	Calculated points	No.	Mean weight	Calculated points
[illegible]	1	5	.62	-	-	-
40	-	-	5.84	-	-	6.92
45	-	-	10.72	-	-	11.70
47.5	1	5	13.39	-	-	-
52.5	12	22.50	21.06	11	21.36	21.09
57.5	23	30.30	29.73	25	28.24	29.01
62.5	48	38.19	37.73	40	36.00	36.67
67.5	54	51.81	43.71	59	41.34	43.00
72.5	29	35.71	47.55	40	49.43	47.37
77.5	22	51.45	49.79	17	50.24	50.55
82.5	7	46.57	51.02	8	62.63	52.39
90	-	-	51.87	-	-	53.82
92.5	-	-	-	1	45.00	54.09

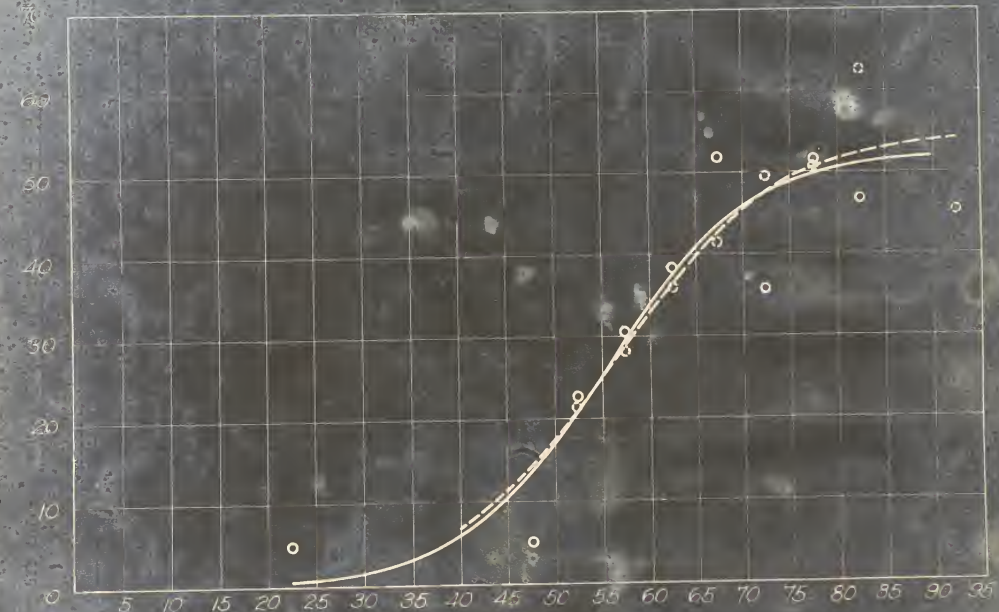

Figure 21.- Autocatalytic growth curve fitted to mean weight of prostate, by year for "Heart negative" and "Heart enlarged, etc."

○ = "Heart negative", and is reproduced from the fitted curve. ● = "Heart enlarged, etc." and the broken line the fitted curve.

Mean systolic blood pressure on admission for the four groups of size of prostate are given in Table XLVI and in no case from a difference between two means approach three times its probable error.

Table XLVI.- Correlation Constants of systolic blood pressure on admission for size of prostate.

Size of Prostate	No.	Mean	Standard Deviation	Coefficient of Variation
Group I	140	152.93 ± 1.12	24.89 ± 1.00	16.22 ± .67
Group II	323	153.82 ± 1.06	26.13 ± .75	18.29 ± .50
Group III	30	151.00 ± 3.40	27.61 ± 2.40	18.29 ± 1.64
Group IV	13	155.00 ± 3.55	19.00 ± 2.51	12.26 ± 1.65
Differences				
Group I - Group II		.89 ± 1.77	3.24 ± 1.25	2.01 ± .84
Group I - Group III		1.93 ± 3.68	2.72 ± 2.61	2.01 ± 1.78
Group I - Group IV		2.07 ± 3.83	5.89 ± 2.71	4.02 ± 1.78
Group II- Group III		2.82 ± 3.56	.52 ± 2.52	.005± 1.72
Group II- Group IV		1.18 ± 3.71	7.14 ± 2.62	6.03 ± 1.72
Group III-Group IV		4.00 ± 4.32	8.61 ± 3.18	6.03 ± 2.33

Correlation between blood pressure and weight of prostate, as shown in Table XLVII is -.054 ± .041, or there is no correlation between the two.

From the foregoing, then, it is concluded that neither heart abnormalities nor blood pressure at operation is associated with size of prostate at operation.

Table XLVII.- Systolic blood pressure on admission and weight of prostate.

Systolic Blood Pressure on Admission.	Weight in grams												
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300	Total
90-99	-	-	-	-	-	-	-	1	-	-	-	-	1
100-109	2	-	-	1	1	1	1	-	-	-	2	-	8
110-119	2	1	3	5	2	-	1	1	-	1	-	-	16
120-129	-	7	5	5	3	2	1	-	1	-	2	-	26
130-139	4	9	6	3	4	-	3	3	1	1	3	-	37
140-149	1	12	5	6	3	6	1	2	1	2	3	1	43
150-159	6	3	5	7	4	3	-	-	2	1	2	-	33
160-169	4	7	7	4	4	1	2	-	-	1	-	-	30
170-179	2	3	7	3	2	2	1	1	1	-	3	1	26
180-189	1	-	1	2	1	1	1	-	-	-	1	-	8
190-199	2	4	3	1	2	2	-	-	-	-	-	-	14
200-209	1	2	1	-	1	-	-	-	-	-	1	-	6
210-219	2	2	1	2	2	-	-	2	-	1	-	-	12
220-229	-	-	-	1	-	-	-	-	-	-	-	-	1
240-249	-	-	-	-	1	1	-	-	-	-	-	-	2
Total	27	50	44	40	30	19	11	10	6	7	17	2	263

$r = -.054 \pm .041$

CONCLUSIONS.

1. An analysis of the Johns Hopkins Hospital cases of prostatic hypertrophy has shown that the mean age at operation of such cases is 66.72 ± .16 years, the mean age at onset of symptoms, 60.22 ± .20 years, the mean onset to admission, 7.43 ± .14 years and the mean weight of hypertrophy at operation 41.26 ± 1.14 grams. The time of life when symptoms are most likely to occur, if at all, is between the ages of 55 and 75, both before and after that age the chances of getting enlarged prostate being less. Between 65 and 75 years of age is the period during which the main part of the abnormal growth of the prostate takes place.

Weight of prostate has been shown to be positively correlated with age at operation, age at onset and onset to admission. This has been interpreted to mean that age and the length of time a patient has had symptoms are associated with degree of hypertrophy and that symptoms if initiated comparatively early in life, increase in severity very slowly.

Regression of weight on age is non-linear, and the curve $y = \frac{b}{e^{-at}+c}$ shows the trend of the means very well.

2. The incidency rate of gonorrhoea among hospital cases of prostatic hypertrophy is 32.68 per 100 patients, or approximately one-third.

Those patients who have had gonorrhoea form a group which differs from those who have not had a history of venereal disease in having a lower age at operation and at onset of symptoms and a lighter prostate, on the average. This may be brought about by a complicating pathological condition due to gonorrhoea. At least gonorrhoea is not associated with increase of hypertrophy.

3. Whether or not a tendency for the prostate gland to hypertrophy is inherited is an interesting problem but the sample available is not large

enough to warrant a definite conclusion. Since there is a negative correlation of size of patient's prostate with a history of tuberculosis in the family, and a positive correlation with prostatic disease in the family it can be argued that age is responsible for both and with so few cases it is impossible to decide the question.

Patients whose mothers died of prostatic disease are possibly distributed differently in regard to weight of prostate from those whose fathers died of a "General disease", while distributed alike for weight of prostate if their mothers died of "senility" or of some "General Disease". This suggests that perhaps age is not wholly responsible for the inheritance of prostatic hypertrophy, but the question is an open one.

There is no association between father's or mother's age at death and patient's age at onset of symptoms or weight of prostate at operation.

4. Single men are not as liable to have prostatic hypertrophy as married men, but, on the other hand, they have as large prostates as married men, when hypertrophy occurs. This last should be qualified however by the statement that as there were only 51 single men among the total hospital experience no very positive statement regarding the weight of hypertrophied prostates among single men is justified.

No relationship can be shown to exist between patients size of prostate and parents reproductive activity.

5. Previous affections of the genito-urinary tract are comparatively few. Infections, stones, hematuria, etc., are apparently not associated with age at onset of symptoms, onset to admission or degree of hypertrophy.

Childhood diseases and certain infections of later life, with the possible exception of scarlet fever, are not related to size of prostate at operation.

Use of Alcohol, likewise has no relationship with patient's size of

prostate.

Men who pursue sedentary occupations are no more likely to have greatly enlarged prostates than those engaged in more active work.

6. The fact that patients with heart affections have slightly heavier prostates than those whose hearts are negative is due to the difference in age distribution of the two groups. Likewise no correlation exists between systolic blood pressure at admission and weight of prostate.

BIBLIOGRAPHY

Ciechanowski, Stanislaus, Anatomical Researches on the So-called Prostatic Hypertrophy and Allied Processes in the Bladder and Kidneys. Translation edited by R. H. Greene, 1903.

Crandon, L. G. G., Pathogenesis and Pathological Anatomy of Enlarged Prostate. Annals of Surgery, Vol. 36, 1902, p. 813.

Daniel, P. L. The Pathology of Prostatic Enlargement. British Med. J., Vol. 2, 1904, p. 1140.

Denver, J. B. Enlargement of the Prostate: its history, anat., aetiology, path., etc., Phil. 1905, Blakiston's Son & Co.

Greene, R. H. and Brooks, Harlow, The Nature of Prostatic Hypertrophy. J. A. M. A., Vol. 38, 1902, p. 1051.

Herring, H. T., The Cause of Enlarged Prostate, etc. British Med. J. Vol. 2, 1904, p. 1136.

Keyes, Edward L., Urology, 1917. T. Appleton & Co.

Does Gonorrhoea Cause Prostatic Hypertrophy. J. A. M. A. Vol. 43, 1904, p. 187.

Lydston, G. Frank, The Surgical Diseases of the Genito-Urinary Tract. 1899. F. A. Davis Co.

Pearl, Raymond, Modern Methods in Handling Hospital Statistics. J. H. H. Bulletin, June 1921, Vol. 32, p. 164.

Pearl, Raymond and Reed, L. J. On the Rate of Growth of the Population of the United States since 1790 and its Mathematical Representation. Proceedings of National Academy of Sciences, Vol. 6, 1920, p. 275.

Pearson, Karl, Table for Statisticians and Biometricians. 1914, Cambridge University Press.

Pilcher, Paul M. Modern Urology. Edited by Hugh Cabot, 1918, Lea and Febiger.

Rothschild, Centralbl. f. Krank. d. Harn. u. Sex-Organe, Vol. 15, 1904, p. 177.

Thompson, Sir. Henry, Diseases of the Prostate, 3rd ed. London 1868. John Churchill & Sons.

Young, Hugh H. Technique of Prostatectomy and Its Relation to Mortality. J. A. M. A. Vol. 79, 1922, p. 933.

Vita.

Mary Gover, (born in Baltimore, Maryland, March 25, 1890), was graduated from the Western High School of Baltimore in 1908, obtained the degree of B. A., Goucher, 1917, and M. A., Hopkins 1917. During the winter of 1913 - 1914 she was instructor in the biology department at the Eastern High School, Baltimore. She held scholarships at the Woods Hole Laboratory during the summer of 1912 and 1914. From 1914-1916 she was assistant to Prof. H. S. Jennings in the Department of Biology at the Johns Hopkins University and also a student in that department; and held a scholarship in Biology during the winter of 1916-1917. She assisted Dr. A. M. Banta (1917 - 1919) at the Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbor, Long Island. Since September 1919 to the present, June 1923, she has been at the School of Hygiene and Public Health, Johns Hopkins University, holding a scholarship the first two years, and an assistant in the Department of Biometry and Vital Statistics during the last two years, 1921-1923.